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The Journal of Applied Psychology

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THE
JOURNAL OF APPLIED PSYCHOLOGY

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THE ABILITIES OF AN EXPERT MARKSMAN TESTED IN THE PSYCHOLOGICAL LABORATORY

ARTHUR I. GATES, Teachers College, Columbia University

The current interest and activity of psychologists in devising and applying tests of special fitness for various vocations required in military operations, may justify a report upon an examination in the psychological laboratory of a man of expert ability as a marksman. Mr. William F. Blasse, of San Francisco, long known as an exceptional marksman, scored the world's record on the 200 yard range, free off-hand shooting, 100 shots consecutively, on September 22, 1916. Using the King Target, Mr. Blasse scored 223 points out of a possible 300 which would have required each of the 100 shots to have been placed within one and one-half inches of the center of the target. Some idea of the accuracy of Mr. Blasse's shooting is indicated by a detailed score; of the 100 shots, 38 scored red flags (within 1.5 inches from the center), 47 blue flags (3 inches from center) and 15 white flags (6 inches from center). The average distance of the 100 shots from center would be about 2.3 inches. Thus at a distance of 200 yards, shooting without a rest, Mr. Blasse would find a man's head an easy mark.

Taken into the University of California laboratory, Mr. Blasse gladly submitted to an experimental examination in an effort to determine in what respects his superiority over the marksmen of average or inferior ability was to be found. From many tests tried, only those which possess some special significance are mentioned. As a control group, 10 students in the laboratory consented to go through the same series of tests.

The group included 2 fair, 4 mediocre, 3 poor marksmen, and one who had shot a gun less than a half dozen times.

First of all it seems important that the expert marksman should have good eye-sight—but does he need to possess exceptional vision? A few stock tests demonstrated at once that while Mr. Blasse's eyes were efficient and without marked defects, they were not markedly above normal. In acuteness of vision, he was not unusual; color vision was normal; neither myopia, hypermetropia nor astigmatism of noticeable amount was present, and the general muscular control was normal. In short, his vision was good but not exceptional.

The second group of tests was concerned with the steadiness of motor control. Most of the tests employed are familiar to the psychological laboratory, and I shall economize space by omitting detailed descriptions of apparatus as well as details concerning the data.

The brass plate steadiness test described by Whipple,[1] with holes whose diameters were 32, 20, 16, 13, 11, 10, 9, 8, and 7 sixty-fourths of an inch, respectively, was first used. Holding the arm at full length, Mr. Blasse showed considerable superiority to the other 10 subjects, by holding the needle for 3 seconds in the hole of 13/64 inch diameter, while the steadiness of the other subjects failed in the next larger hole (16/64 inch), 6 others touched the sides of the 20/64 inch hole and one student failed in each of the 4 trials in the largest hole (1/2 inch). These relations held approximately for either hand, although the right hand was, on the whole, somewhat more steady.

For measures of the steadiness of one form of voluntary muscular control, the "tracing board" test[2] was employed. Several tests were made with the board placed at different angles, and in all these tests Mr. Blasse was somewhat, but not markedly, superior to the other subjects. The most steady student was quite as good.

The so-called "target test," designed to measure the accuracy and precision of movement[3] consisting in thrusting a pencil at a target placed at arm's length, showed that in this form of motor control, Mr. Blasse was only slightly superior to the average of ten students. The three tests just described, when considered together, show that the expert marksman is considerably superior in simple steadiness of motor control, but only slightly superior to the average in accuracy and precision of arm movements. In a final test (the tapping test) which measures mere speed of motor control, Mr. Blasse showed approximately average ability.

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[1] Manual of Physical and Mental Tests, 1910, p. 124.

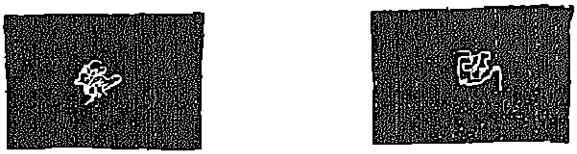
[2] Whipple, *op. cit.*, p. 120.

[3] Whipple, p. 115ff.

Not only is the steadiness of the arm involved in holding a gun, but the steadiness of the body as a whole. To measure this form of motor control a simple apparatus was used. A helmet was placed upon the head, projecting upward from the top of which was a stiff pointer. A smooth platform, like that of a punching bag, over which was stretched a paper covered with a thin layer of smoke, was adjusted so that it came into contact with the top of the pointer. The subject then attempted to stand motionless, every slight sway of the body being recorded by the tracings of the pointer on the smoked surface. Mr. Blasse showed some superiority in this test, his bodily movements being less marked than those of the steadiest students. The accompanying tracings (Fig. I) show the actual movements made by Mr. Blasse, a student of average, and one of marked unsteadiness. An interesting feature brought out by this test was that Mr. Blasse was subject to distraction or suggestion with regard to movements to a much less extent than were most of the other subjects. If I told certain subjects that they were swaying forward, efforts to counteract this imaginary movement would usually result in greater unsteadiness. If I told them to think hard of something to their left, as a rule the body would sway in that direction. A sudden slap of a book on a table usually provoked a series of movements and, most significant of all, if the subject thought intently upon the possibility of his increasing unsteadiness—if such ideas as: "I'm awfully unsteady to-day," "There, I moved again," "I can't seem to control myself," were dwelt upon, the results were disastrous. Now, Mr. Blasse was relatively cool and unmoved during all such procedures, although the general surroundings, the apparatus and so on were less familiar to him than to the other subjects, and although a certain fear lurked in his mind that he was not going to do well in these strange tests. The fact that Mr. Blasse was relatively non-susceptible to motor suggestibility is important.

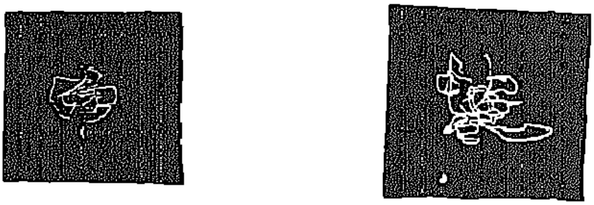
Thus we have found that the expert marksman is possessed of superior steadiness of muscular control in the various stock tests. Finally, a test of the steadiness of the gun itself, which would result from various movements in combination, were measured. For one method, a steel needle was fastened to the end of the gun and the movements were recorded by means of the metal plate of small holes mentioned before. In this test, with the gun in hand, Mr. Blasse's superiority was more pro-

FIG. I



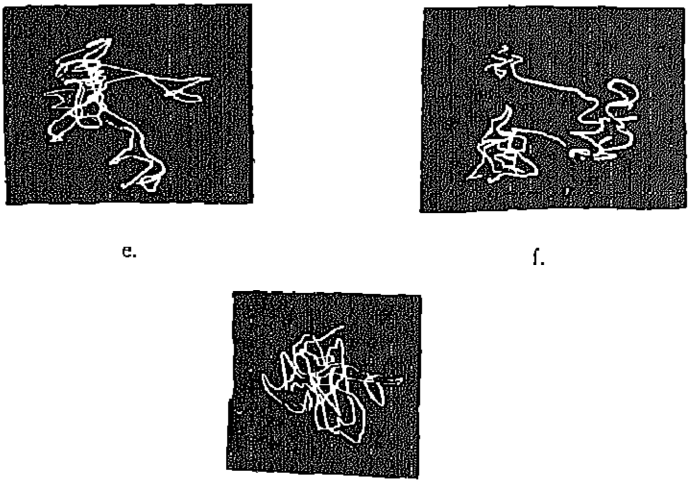
a. b.

a, b. Tracings made by Mr. Blasse in the "overhead register" steadiness test.



c. d.

c, d. Very good tracings made by other subjects in the "overhead register" test.



e. f.

g.

e, f, g. Tracings made by subjects under suggestion. (e) suggestion of moving to right, (f) of moving to left and (g) of being "awfully shaky."

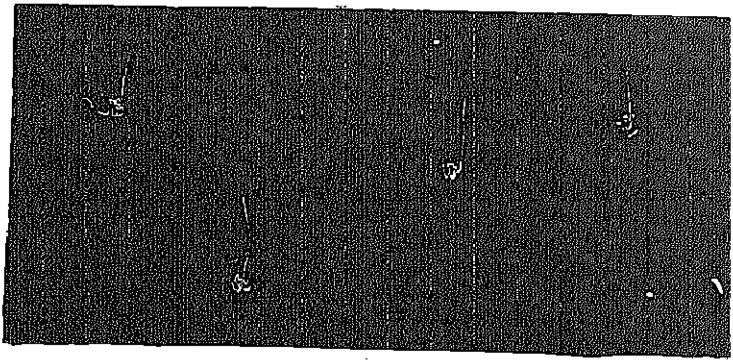
nounced than before. He was able to keep the pointer in a hole of 13/64 inch diameter for several seconds without touching, while most of the other subjects incessantly bumped the sides of a hole twice as large.

A more realistic test consisted in arranging a pointer which played against a smoked surface two inches below the end of the barrel while the subject aimed at a target and discharged a blank cartridge in the same manner employed in actual shooting. The accompanying records (Fig. II) tell the story better than words. It will be noted that the tracings made by Mr. Blasse's gun cover an exceedingly small range, that the sight is quickly obtained and that immediately after the discharge the gun is moved perpendicularly upward with a quick pull. The records for the other subjects show a faltering over a large area, with wide excursions in all directions. As the gun wabbles about the subject attempts to pull the trigger when the bead happens to hit upon the bullseye, and in this effort he is doubtless often unsuccessful. The clean cut, upward withdrawal of the rifle after firing is seldom shown, sometimes because it does not occur and often because the subject permits the gun to be jerked backward from its original position upon firing. It should be remembered that an excursion of a small fraction of an inch shown on the tracing would mean a wide miss when projected to a field 200 yards distant. Some of the subjects would probably have done well to "hit the side of a barn."

Aside from general steadiness and control of the bodily muscles, the action of the fingers controlling the trigger may have some bearing upon the result. Mr. Blasse habitually uses a sensitive trigger and in his opinion the action of the forefinger muscles with the required delicacy and at the right moment is an essential factor in the success of the shot. An exact graphic record of the control of these muscles was obtained by a simple apparatus. Over the bowl of a so-called "thistle tube" is stretched a delicate rubber membrane and the outlet at the small end of the tube is connected with a tambour. With the hand resting comfortably, the subject was given several tasks to perform with his forefinger. First he was asked to tap the membrane many times in succession, each time with equal force (see Fig. III). In the figure, the height of the line gives a picture of the force exerted by each tap. It requires no special measurement to see Mr. Blasse possessed some superiority in this capacity.

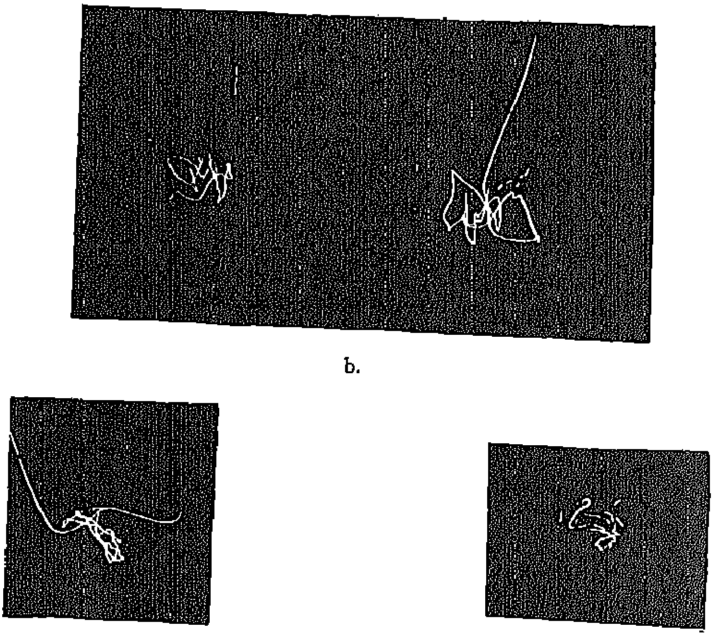
Using the same apparatus, the subject was asked to press down with uniform pressure and speed upon the membrane,

Fig. II



a.

a. Records made by Mr. Blasse, showing the movements of the end of the rifle during aiming and firing. The straight vertical lines are made by the quick "pull away" of the rifle immediately after firing.



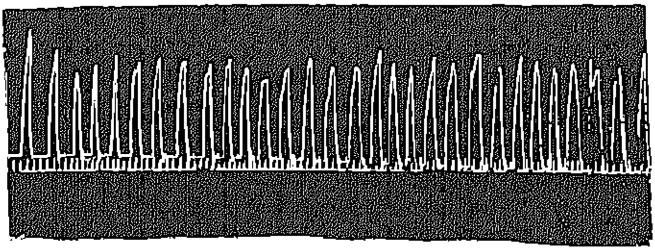
b.

c.

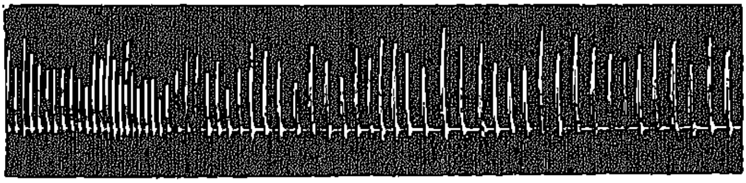
d.

b, c, d. Aiming and firing records made by other subjects. d. was made by a very good rifleman.

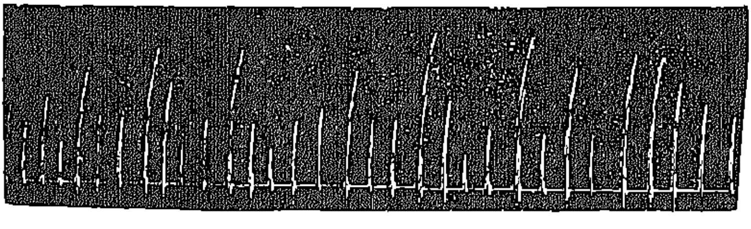
FIG. III



Record of Mr. Blasse attempting to tap the membrance of the thistle tube with uniform force. The height of the lines indicates the force of each stroke.



Record of an average subject in tapping.



Record of a very poor subject.

and then to release the pressure with equal speed. This test, which was repeated many times in succession, is a very trying test of muscular control. If speed and force remained constant throughout, a symmetrical curve would appear. The test was tried in several different positions, i.e., pressing downward perpendicularly, pressing it toward the left, pulling inward against it as one would in pulling a trigger. The curves illustrated here (Fig. IV), are for the latter task, and Mr. Blasse's superiority here is quite clear. The best record from the student subjects is not greatly inferior, however, and with practice this student might have developed to the marksman's equal in this respect. In general, however, Mr. Blasse not only greatly surpasses the ordinary person in steadiness of motor control, but also in the delicacy and precision of action with the trigger finger, which may, indeed, be of considerable significance.

The last group of experiments include certain tests in reaction time, the Hipp chronoscope being employed. All of the subjects were given preliminary practice, followed by 50 trials in each test. In single reactions to sound (telegraph key) Mr. Blasse showed an average of 119σ[4] as compared to an average of 124σ for 8 students, although three of these were superior to him. A similar test for a reaction to a sharp stroke of the left hand, gave an average time of 115σ for Mr. Blasse, and an average of 118σ for the 7subjects. Again three students responded more quickly in this test than did the marksman.

Another test, employing the same general apparatus, has more significance for the present purpose. An apparatus was provided such that the subject reacted by pulling a trigger in the same manner as employed in firing a gun. About 10 feet in front of the subject was placed the white end of a metal rod about a quarter of an inch in diameter which showed plainly on a black ground. Fastened to the end of a metal rod which was blackened so as to be almost invisible against the ground was placed another white piece of metal about 1/6 of an inch in diameter, which could be moved about in various ways and could at any time be brought into contact with the stationary spot of white first mentioned. When a contact was made between the two, the electric current was closed which set the chronoscope in action. The chronoscope was stopped when the subject pulled the trigger and thus the time between the coincidence of the spots and the pulling of the trigger was recorded. By moving the free spot of white all around the other, now approaching, now receding, now wavering here,

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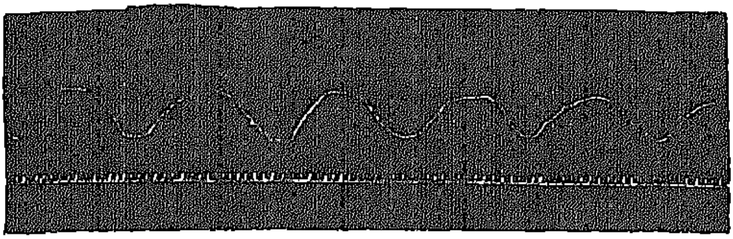
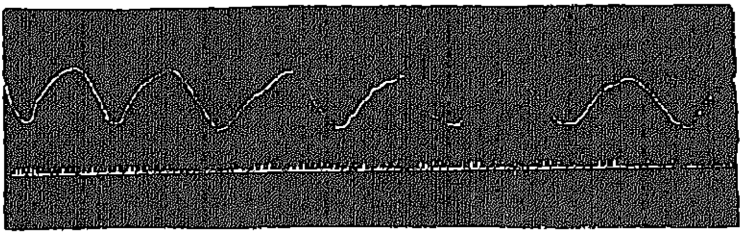
[4] σ equals a thousandth of a second.

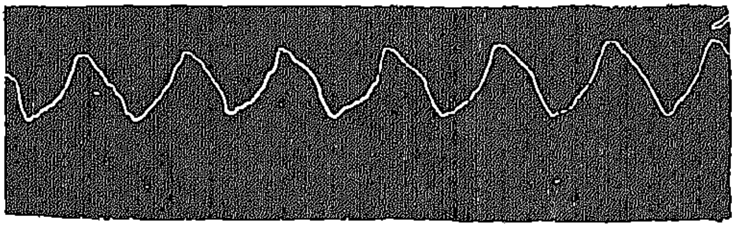
FIG. IV



Record of Mr. Blasse attempting to pull in and release the membrane of the thistle tube with uniform force.



The best record among the other subjects with the thistle tube as above.



One of the poorer records.

now there, before a contact was actually made, a situation similar to the bead of a rifle wavering about a target in actual shooting was secured. The speed and uniformity with which the trigger is pulled after the imitation sight coincides with the imitation target, gives a significant account of the coordination between eye and hand which would be of influence in shooting. If the trigger is pulled too quickly or too slowly, the bullet goes wide of its mark. What will be of special significance here is not only the speed of the reaction but its uniformity during a series of shots. If, for example, after the impulse to pull the trigger is initiated, the time elapsing before it is actually pulled is now 100σ, now 200σ, and at other times 150σ, 250σ or 90σ, it can readily be seen that the discharge will usually not occur at just the right time, since the gun is usually in motion. The impulse to pull, probably occurs just as, or just before, the bead begins a passage over the bullseye. But suppose the time elapsing between impulse and pull is always uniform, that is to say, for illustration, it is always 150σ or but a few sigma more or less. Since the interval is always about the same, the shooter comes through experience, through trial and success, to know just when to start the impulse to fire. He would then meet with success, even if his reaction time were fairly slow, although of course, the speedier the action the better.

The results from the reaction time tests are presented in briefest form by giving the average time with the mean variation, (this figure being the more significant) together with the number of premature reactions, or cases in which the subject reacted before the two white spots touched, i.e., before the signal was given. Fifty trials were given each subject in each test.

The following table gives the results for the irregularly moving test.

Av. sigma	M. V.	Premature reactions
	Mr. Blasse	
158	18	0
	Av. of 8 other subjects.	
198	96	6

Mr. Blasse's reactions are on the average much quicker, and very much more uniform, the M. V. of the others, on the average, being 5 times as great. Moreover, Mr. Blasse did not, in a single instance, "jump the gun," while the others did so on the average of one time out of 9 trials.

The following figures give the results of tests in which the movable white spot instead of wavering about in an indefinite manner as above before finally touching the stationary spot, approached in one direction at a uniform speed.

Mr. Blasse—approaching from above downward.

Av.	M. V.	Premature reactions
155	10	0
	Approaching from below.	
162	13	0
	Approaching from right.	
152	9	0
	Approaching from left.	
150	10	0

Av. of from 8 to 10 other subjects.

Approaching from above.

Av.	M. V.	Premature reactions
142	48	7
	From below.	
179	66	4
	From right.	
145	48	6
	From left.	
159	52	5

In these tests, Mr. Blasse shows no superiority as regards speed of reaction, but this is due in large measure to the fact that many reactions of the other subjects followed upon premature impulses although the chronoscope was started before the reactions were completed, thus accounting for such impossible reaction times as 50σ etc., which cut down the average markedly. In many cases, as shown above, the impulse was initiated so early that the reaction was completed before "sight" and "bullseye" came into contact. In no case did Mr. Blasse make such a premature reaction. In fact the regularity of his responses is the most conspicuous superiority, and, as indicated earlier, this is a vital capacity in the development of marksmanship, since it offers the possibility (no matter what the actual time of reaction may be) of establishing a habit with regard to the moment of initiating the impulse to "pull" the trigger. So long as the reaction time is approximately the same, and the movements of the gun can be fairly well controlled, experience can readily supply the other requisite elements.

We may now summarize briefly the capacities which seem to characterize the champion marksman. His vision is not exceptional, although he has no special eye defects. It seems reasonable to suppose that for practical shooting, exceptionally keen eyes are not essential and even such eye defects as myopia, astigmatism and the like (which may be corrected by proper glasses) are not prohibitive of good marksmanship. Muscular difficulties of convergence which interfere with the movements of the two eyes together need not be a handicap since many expert marksmen shoot with one eye closed.

Muscular steadiness of the members of the body which are brought into action in holding the gun on its mark is of great importance. This was shown by all the tests that were employed. Of special import is the ability to resist the influence of various disturbing factors upon one's steadiness, such as slight distractions and especially subjective anxiety and autosuggestion. The type of individual who is keenly aware of and disturbed by his own unsteadiness during shooting only increases his unsteadiness thereby. While muscular steadiness is doubtless not absolutely essential to skill in shooting, as evidenced by several good marksmen who are quite shaky, it certainly affords a great advantage.

A nicety of muscular control of the fingers involved in manipulating the trigger perhaps plays a rôle although this function should really be considered in connection with the results of the tests on reaction time. Our expert marksman showed a remarkably fine correlation of eye and hand in these tests. While nerved up, in such a test and likewise in actual shooting, to a high sensitivity, "breaks" in nervous control did not occur. The ordinary shooter, like the nervous athlete waiting the pistol, often "jumps the gun," that is, he pulls the trigger before the sight is perfect, or if he does not do this, he is unprepared when the proper moment comes, and the trigger is pulled too slowly. But our expert fails in neither of these respects. His reaction is never premature, and when bead and target are in the proper relation, the reaction is made with dispatch and always with great uniformity. This calm, speedy and uniform reaction is of utmost importance. Coupled with steadiness of general muscular control, this capacity seems to be essential to skill in marksmanship.

To what extent is the superiority of the expert in these tests due to training in shooting and to what extent is it due to native ability—ability possessed before practice,—is a matter of importance upon which our present data afford little evidence. If we pick out a hundred men at random—say, any hundred of the men conscripted for government service—we would find that a few had received considerable, many a little and many no previous practice with a rifle. If we wished to select from these, a number who are destined after practice, to become the best sharpshooters, we must employ tests that divulge native, and not acquired ability. It must be admitted that much more work must be done with these and other tests before this matter can be decided with certainty. It will be necessary to test individuals who have had much experience in shooting but have developed but little skill. If our tests are valid for this purpose, such individuals would do poorly in them. It may be stated, at least, that of the 10 subjects beside Mr. Blasse who went through the tests, one whose experience in shooting was considerable was among the poorest in the tests, while one who was the best in most of the tests had shot a gun less than a dozen times during his life.

It would be interesting to know, also, what influence various habits of life have upon the capacities required for marksmanship. It might be said in passing that Mr. Blasse is a man of good habits. He has never indulged in smoking or drinking. With regard to smoking, data obtained in these tests from one rather heavy smoker are interesting. In the steadiness tests he was poorer than any of the other subjects and his shakiness was particularly noticeable just after smoking a cigarette. If permitted to wait for 12 or 15 minutes, his steadiness returned to his norm, however. This single record cannot be taken to prove that smoking makes one decidedly unsteady, for many other factors must be considered and many other similar tests performed to make certainty of such a statement. The fact may be that the person who is naturally unsteady or nervous, may more readily become addicted to smoking. That is, some people may smoke because they are "highly strung" or nervous, and are not so unsteady just because they smoke.

This examination of skill in marksmanship is, of course, preliminary and uncertain. Some of the tests here described could well be omitted for practical purposes, and doubtless all could be improved and new ones should be added. Some may say, in fact, "Why not give a man a gun and let him show his ability by shooting a few times!" Well, there are good reasons. In actual shooting, experience plays too large a rôle. The novice must be shown how to hold the gun, whether to grasp it tightly or laxly, whether his bodily muscles should be held lax or taut, whether he should pull the trigger slowly or with a sudden jerk, how much of the front sight should be visible in the notch of the rear, whether he should aim at the bottom, center or top of the bullseye, whether he should "hold steady" on the bullseye or move up to it, not to mention the adjustment to and fear of the noise, flash and "kick." The knowledge of these conditions and the adjustment to them depends mostly on experience in shooting, not upon *innate* ability to eventually become a good marksman. The laboratory tests aim to measure this undeveloped ability, although the present series may not do so adequately.

MENTAL TESTS OF UNEMPLOYED MEN

Rudolf Pintner and Herbert A. Toops, Ohio State University

Part II.

(Continued from the previous issue.)

Dayton Free Employment Office.

Opportunity was offered to make an investigation at the Dayton Free Employment Office similar to the one already reported. The results of such an investigation would serve as a check upon the work at Columbus. It also serves to show the effect of the environment of the office upon the character of the applicants.

Dayton is a town of 200,000 inhabitants. It is in many respects more of a manufacturing city than Columbus. At the time of the investigation many skilled workers were out of work due to strikes and to munition factories closing down upon the completion of their European war orders. The employment office, in contrast to the one at Columbus, is located on the third floor of a modern business building in one of the principal business streets of the town. The superintendent tries to encourage applications of high grade men and to discourage applications of unemployable and undesirable men.

Forty men were examined during the last ten days of the year 1916. These men represent about 30 per cent of the total

Table VIII—Distribution of All Mental Ages—Dayton

Mental age	No. of cases	Per cent
7	1	2.5
8	2	5.0
9	3	7.5
10	7	17.5
11	9	22.5
12	4	10.0
13	3	7.5
14	2	5.0
15	..	..
16	3	7.5
16+	6	15.0
Total	40	100.0

new applicants during that period. The tests, questions and methods were exactly the same as in the Columbus investigation. The results, therefore, are directly comparable.

The distribution of mental ages, according to the Point Scale in five cases and according to the other tests in the remainder, is shown in Table VIII. The distribution approaches more nearly to a normal distribution than in the case of Columbus. There is a suggestion here of a division into two classes, one of average ability and one of superior ability. The diagnosis of the 40 cases was: Feebleminded 3; Borderline 10; Backward 13; Normal 8; Bright 6.

Industrial Class.

Table IX shows the relation of mental age to industrial class. The order of these classes both as to numbers and mental index is the same as in the Columbus investigation. No "unemployables" were found in this investigation. The three lowest mental ages of native whites were possessed respectively by an "odd jobs," a questionable "unemployed," and a "casual" worker. All of the colored and foreigners are rated as unemployed, thus indicating a rather high grade of men from an industrial point of view.

TABLE IX—MEDIAN MENTAL AGE OF INDUSTRIAL CLASSES—DAYTON

Indus. Class	No. of Cases	Median M. A.
Unemployed	33	12.0
Casual	2	10.6
Odd Jobs	5	10.2
Unemployable	0	....
Total	40	11.8

Four professional men, prominent in Dayton life, were tested by the same tests. All four had a mental age of 16+. In only a few of the separate tests did any of these four men do poorer than the best of our group of forty.

The relation of mentality to age was found to present similar features to those found in Columbus, namely a tendency for the mental age to decrease as the chronological age increases.

Education.

The median grade at leaving school is 7.4. Compared with Columbus, we find a much smaller proportion of persons leaving in the lower grades, and a much higher proportion reaching the higher grades. We find that 13, or 32.5 per cent of our 40 had at least entered high school. We thus find the educational attainments in keeping with the higher mentality of the group.

Comparison of the Two Offices.

The composition of the groups at the two offices shows many points of similarity. The Dayton applicants, however, seem to be of a higher quality. This higher quality is in part due to the industrial conditions in Dayton at the time of the investigation and in part to the discouragement of applicants of low quality in that office.

The mental indices of the two groups, 10.5 for Columbus, 11.8 for Dayton, indicate the superior mentality of the Dayton group. The foreign born have the highest mentality in both groups, followed in order by the native whites and colored. There is a significant difference in the mentality of the Columbus whites and colored. The colored applicants are all recent immigrants to Columbus from the South. At Dayton where the colored applicants are mostly Northern born the mentality difference between the two groups is only slightly in favor of the native whites.

By diagnosis it is estimated that the percentage of feeble-minded at Columbus is 28.7, while at Dayton it is only 7.5. There is also a higher percentage of borderline cases at Columbus than at Dayton, 29.8 per cent as contrasted with 25.0. Dayton is credited with a higher percentage than Columbus in each of the remaining mentality groups. This is especially true of the normal and bright groups. The bright group is almost lacking in the Columbus office.

The Dayton office has the largest percentage of desirable men. In the unemployed class there is 82.5 per cent as compared with 64.0 at Columbus. The different industrial classes differ in mentality in each office in the same order: the unemployed have the highest mental index, followed in order by casuals, odd jobs men and unemployables. The last class was unrepresented among the applicants at Dayton. The order of frequency of occurrence of the industrial classes is the same in each office: unemployed, odd jobs, casuals and unemployables.

Comparison with other Investigations.

Johnson[1] in his study of the unemployed of Portland, Oregon, used the Stanford Revision of the Binet Scale. We, therefore, have no assurance that his results are comparable with ours. Since his investigation took place during the employment crisis of 1914-1915, while ours took place under more normal conditions, we should not expect the same results even if the tests were comparable. He found about 21 per cent to be feebleminded. We have found 28.8 per cent at the Columbus office. We should expect to find a larger percentage than he did, since under our conditions mentally defective persons would form a larger proportion of the total applicants than at a time of an unemployment crisis, when large numbers of more intelligent applicants are out of employment. The industrial conditions in Dayton may presumably be regarded as much better than those in Portland during the investigation, and accordingly we find at Dayton a smaller proportion of feebleminded, 7.5 per cent as compared with 21 per cent at Portland.

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[1] Johnson, B. R. Unemployment and Feeble-mindedness, *J. of Delinquency*, Vol. II, 2, 1917. pp. 59-73.

Terman[2] reports the testing by Knollin of 150 hoboes, of which 20 per cent at least were feebleminded and almost as many more borderline cases. Our findings seem to parallel this report in surprising manner. Indeed many of our men belong undoubtedly to the hobo class.

It is interesting to compare the mental make-up of our group with that of convicted criminals. Pintner and Toops[3] used these same tests in testing the population of a workhouse. The results are directly comparable with the results of the employment office investigations. For purpose of comparison of our men with these workhouse inmates the percentages falling in each mentality group in the three separate investigations are tabulated in Table X. The similarity of the figures for the Columbus Employment Office and the workhouse is startling.

TABLE X—PERCENTAGE DISTRIBUTION BY MENTALITY GROUPS IN THE COLUMBUS AND DAYTON EMPLOYMENT OFFICES AND IN A WORKHOUSE

Diagnosis	Dayton Employment Office	Columbus Employment Office	Workhouse
F. M.	7.5	28.7	28.8
Borderline	25.0	29.8	29.6
Backward	32.5	28.7	31.0
Normal	20.0	8.5	10.6
Bright	15.0	4.3	0.0
No. of cases	40	94	132

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[2] Terman, L. M. *The Measurement of Intelligence*, Houghton Mifflin Company, Boston, 1916. p. 18.

[3] Pintner, R. and Toops, H. A. A Mental Survey of a Workhouse. *J. of Delinquency*. Vol. II. No. 5, Sept., 1917, pp. 278-287.

All of the investigations we have mentioned show agreement in that a high proportion of mental deficiency is found to be a very decided factor in the production of poor adjustment to the conditions of life now existing. Inasmuch as men are so closely bound up with their industrial life we may expect mental deficiency to show itself by such symptoms as inefficiency, unemployment, vagrancy and crime.

Education of All Applicants.

Since education has such an intimate connection with our problem, being not only in a large measure determinative of the industrial position which an individual is allowed to hold, but also, as shown by the investigation, having an intimate relationship to the mentality of the group, it was decided to determine the educational attainments of all applicants registering at the office for a long period of time. The records of the office allow this to be readily accomplished.

In Columbus a tabulation for four months was made. The median grade at leaving school for the applicants reporting each month was 7.1, 7.2, 6.8 and 7.3 respectively. The median grade for the total 1608 applicants was 7.0. In the report for the four months 19.9 per cent of the total applicants did not report the grade at leaving school. Since the period covered by this tabulation is in the very midst of the period of our investigation, the men selected for examination are largely from this group. Since the men selected had a median grade at leaving school of 6.6, we may regard them as being about equal to the average applicant. They, perhaps, would have been equal had the other 19.9 per cent been reported, many of whom were undoubtedly illiterate and thus not able to report the item on their registration card.

Of the 1608 applicants, 4.3 per cent had never been to school; 9. 5 per cent had not more than a second grade education; 17.6 per cent had at least completed one year of high school, but only 4.6 per cent had completed the high school course; one out of every 58 had entered college, but only one out of 400 had completed a college course.

The median grade at leaving school of 7020 applicants during the entire year at Dayton was 8.3. The forty applicants examined from this office had a median grade at leaving school of 7.4. Evidently the applicants selected for examination were somewhat below the average in educational achievement.

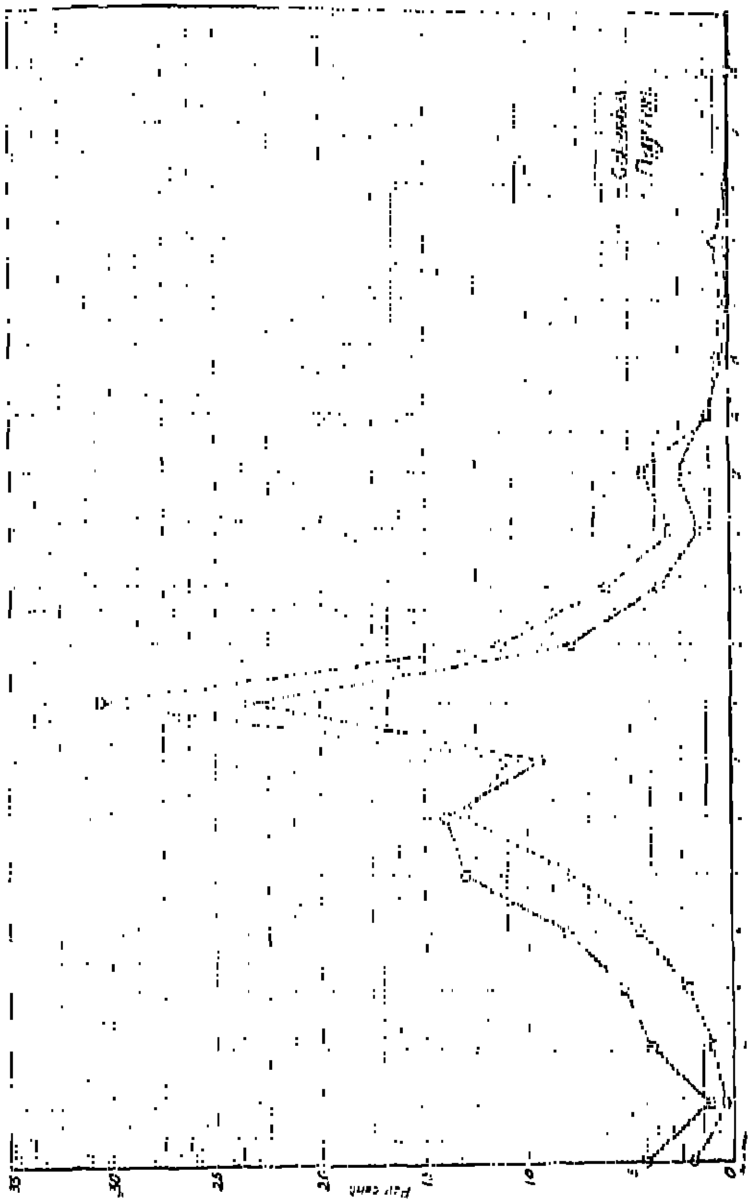
In line with our belief that the grade at which individuals leave school is determined not so much by industrial conditions as by mentality, and in view of our findings, namely that there were more applicants of lower intelligence and fewer of higher intelligence at the Columbus office than at the Dayton office, we find that the educational attainments of the two groups corroborate this theory. There is a decidedly larger proportion of applicants leaving school at Columbus before the end of the sixth grade than at Dayton; after the seventh grade, there are decidedly fewer applicants who have secured education of a higher grade. These facts are well illustrated in Graph IV. The effect of the psychology of completion is also well shown in both curves at grades 7 and 8 and at the third and fourth year of high school. We may well believe that the peculiar shape of the curves at these points are due to this factor. Individuals whose limits of ability are about reached at grade 7, and who ordinarily would have dropped out of school at that point, by the prospect of "graduating" by one more year of work, are thereby induced to go to school for one year more. The effect of this upon our curve is to reduce the percentages leaving school at the seventh grade and also at the third year of high school, and to increase the percentages leaving at the eighth grade and the fourth year of high school. The probable effect upon the schools is that the quality of the graduating classes is slightly lowered. This result is, however, not to be regretted, if the additional year of school fits these individuals better for their work after leaving school.

There are probably different amounts of education required as a minimum for success in each particular occupation. What these minimum amounts are, we do not yet know. A further investigation of this would be desirable. If we arbitrarily assume that at least a fourth grade education is required for any of the unskilled occupations, then 10 per cent of the Dayton applicants and 28.8 per cent of the Columbus applicants have not more than this minimum.

Conclusions.

It now remains to be pointed out in what way the results of this investigation may be made of use in a program of industrial and social reform.

.We have seen how defective mentality is apt to result in a multitude of social mal-adaptations. The individual so afflicted is unable to compete on equal terms with his fellow men, and consequently soon after beginning his industrial career, starts on the downward path which leads from occasional unemployment to habitual underemployment and may lead to unemployability, through the devitalizing influences due to lack of



Graph IV. Percentage of All Applicants Leaving School at Each Specified Grade. Columbus and Dayton.

work and consequent lack of means of support. The last step in the series, as suggested by the comparison of the mentality of the employment office applicants and by the careers of the men themselves, may possibly be actual criminality or, if not that, then entire social dependency.

The social significance of a class of unemployable or habitually underemployed feebleminded men is thus enormous. From a social, industrial and humanitarian viewpoint we should prevent this last step of the series being taken by any individual.

We have also noticed that different degrees of mentality seem quite well correlated with the occupation, wages, permanency of position—in a word, with the industrial success of the individual. A general scheme of social reform would include plans for enabling the individual to develop to the extent of his mental ability and to "find his level" in the industrial world. As Terman says; "The ability to compete with one's fellows in the social and industrial world does not depend upon intelligence alone. Such factors as moral traits, industry, environment to be encountered, personal appearance and influential relatives are also involved." It would thus seem that in many cases of inferior mentality this lack, if not too great, may in large measure be overcome by other factors, chief of which would seem to be proper preparation in school for the later demands to be made upon the individual. The school curriculum of the present does not fit such individuals for life's struggles. Our investigation has shown that such individuals are compelled to leave school after reaching the limit of their ability and before having acquired the training necessary for anything more than sure failure or minimal success in industrial life. A system of vocational education, in which the individual is trained to the extent of his abilities in such ways that the training will be of use in later industrial life, is badly needed. Systematic periodical mental testing of all school children would form one of the important phases of this system.

In regard to the problem of unemployed adults, ideally it would be desirable to eliminate all mental defectives by establishing a state institution where high grade morons could be sent and allowed to work for wages and support themselves to the extent of their ability. This institution would be distinctly different from a "feebleminded institution," in that commitment would be voluntary and that conditions would be such that life in the institution would be more desirable than competition in the struggles of the industrial world. Such a system could be inaugurated only by a cooperation of state and school and would have to begin with the children.

Since, however, the problems of the employment office are present ones and problems which would cease to exist only after the system just mentioned had been put into successful operation for some length of time, it seems better to recommend a procedure which could be adapted to present conditions.

1. Test the mentality of all applicants by means of group tests.

2. Establish four or five classes, determined primarily by mental age, and ranging from "excellent" downwards, to one of which each applicant may be assigned upon the result of his test. The class of each applicant is to be used in determining to what kind of position the applicant may be referred.

3. Employ a "follow-up" system whereby an applicant's industrial career may be traced. In those cases where perseverance, temperance, industry, etc., would seem to be able, in a measure, to offset the burdens of inferior mentality, the class of an individual may be raised. For opposite reasons the class may also be lowered.

4. Recommend to positions only those persons whose mentality is at least equal to the demands of the position. Refuse *to recommend to positions any person belonging to the lowest* class.

Let us see what would be the probable outcome of such action. In the first place, we will eliminate a certain element whose employment is of doubtful value, either economically or socially, under any conditions. Society will have to make provision for these dependents and this in turn will hasten the day when provision will be made whereby this entire dependency may be avoided.

Secondly, we may expect a progressive betterment in the kind of applicants who make use of the employment office. This *will not only encourage more high grade men to apply* at the office when out of work, but also will encourage the use of the office by employers when in need of help, thus materially aiding in securing the results for which the offices were established.

Thirdly, we may expect a decrease in the number of applicants in the beginning, but this may be expected to be temporary only and to be offset by the greater satisfactoriness of the men recommended to positions. One very desirable feature of such a system would be the collection of a vast amount of industrial information, becoming more and more valuable with the addition of new material, which might be used as a sound basis for a system of vocational guidance of youth. The system might well be expected in time to grow into a bureau in which all men of a community would be registered, and having to do with the granting of standard recommendations, securing promotions, or positions when unemployed, and in the extension of its field of activity to employed as well as to unemployed men, the obtaining of statistics for vocational guidance. In a word such a system stands for industrial evolution while the present system is making no remarkable progress when regarded in the light of industrial and social progress in general.[4]

Summary. 1. A sampling of applicants at two employment offices, as nearly as possible representative of the men in general applying at these two offices, was given a series of mental tests in order to determine approximately the mentality of such applicants in general.

2. The results at the first office show a very high percentage of feebleminded, borderline and backward cases. The percentage of normal or above normal is only 12.8. The percentage of feebleminded and borderline together is 58.5.

3. There seems to be a distinct relationship between the mentality and the industrial class to which a man belongs, the unemployed class ranking highest, followed by the casuals, the odd jobs men, and the unemployables. No men of normal mentality were found in the unemployable group.

4. On the whole the older men among the applicants seem to be more retarded mentally than the younger men.

5. A study of the birthplaces of the applicants seems to show that the class as a group is migratory in character.

6. The best position ever held, as given by the men themselves, shows that few have ever held positions requiring any considerable degree of responsibility.

7. The grade in school achieved by the men, according to their own statement, is higher than their mentality in general

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[4] Since writing this article one of the employment offices has become a clearing house for all the large industrial concerns of the city. All the large manufacturers have ceased advertising and rely upon the office for securing their employees. If this principle could be extended so as to include all of the employees in the city, the system would then resemble somewhat the plan outlined above. Have all employees of a community registered in one central office so that recommendations of this office would be worth while, because the records would be complete.

would warrant, although it bears out the poor mental endowment of the class.

8. The median grade at leaving school of the group tested in the one office is 6.6, and in the other 7.4, slightly lower than the median grade for all applicants in either office.

9. The results of the control investigation at the second office bear out in general the results in the first office, with the exception that the general level of the applicants in the second office is above that of those in the first office. The location and method of conducting the office has a distinct influence upon the type of men applying at the office.

10. By means of the mental tests, which we already possess, much could be done to increase the efficiency of our employment bureaus.

CORRELATION BETWEEN DIFFERENT FORMS OF SENSORY DISCRIMINATION

By John A. Stevenson, University of Illinois

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I. *Introduction*

The study of relationships between mental traits and between mental traits and physical traits has centered mainly about four problems:

1. How are the various mental and physical traits interrelated? Such problems as the correlations between sensory discrimination and memory, between memory and reasoning ability, between motor functions and mental functions, etc., have been studied. The investigations have so far yielded discordant results, and the question of the relative dependence or independence of various traits and functions has given rise to much controversy.

2. How are the various mental and physical traits related to general mental ability or general intelligence? The interest in this problem has been due, no doubt, to the possibility of discovering some one trait or group of traits, the measurements of which might serve as an index of mental makeup. The difficulty of securing an unambiguous measure of general intelligence, as well as a satisfactory measure of special mental traits, has led again to widely varying results.

3. How are the results of mental functions, as shown in school subjects, correlated? The practical bearings of such determinations on the grouping of subjects and their disciplinary value, as well as the light they might throw on the relationship between various mental processes, have led to numerous investigations on correlations between school marks.

4. How are the abilities with varying data in what is in descriptive psychology ordinarily called a single mental func-

tion, correlated? Such problems as the correlation between memory for colors, sounds, numbers, words, etc., between immediate memory and secondary memory, between memories as affected by various modes of presentation, have received some attention.

The accumulating evidence on these four problems has shown a surprising lack of correlation in cases where common observation and opinion would have led one to expect a high correlation (9).[1] The evidence points apparently to a great specialization in mental functions and marked independent variability. So marked is this independence and so contradictory oftentimes to common experience that one is led to suspect that the lack of correlation is due to the presence or absence of factors other than those supposedly measured. Moreover, the more recent investigations have shown that the earlier extreme view of specialization and independence is not tenable. Thus Thorndike (9) is inclined to distinguish at least three levels of mental action—sensitivity, association, and analysis, which would show "closer intro than inter-relations." It is with the correlations within the first of these levels that this investigation is concerned.

The specific problem is the correlation between different forms of sensory discrimination at different stages of practice. The results of the few studies that have been made, have, in general, shown that sensory discrimination is rather highly specialized. That is, high ability in discriminating color or brightness may go with low ability in discriminating tones or pressures or lifted weights or lengths of lines. The evidence has, however, been based either on too small a number of cases to be entirely convincing, or, on a comparison of discriminativeness with varying amounts of practice and interest.

Several questions or problems bearing on the matter have not been satisfactorily worked out:

1. The number of tests necessary to secure an adequate measure of an individual's capacity in discriminations. It is certain that a single test or a few tests will not give a measure of sensory discrimination, whatever else it may give. From a methodological point of view, it is important to discover how great the number of measurements must be in cases where practice is so notoriously effective as in sensory discrimination in order to furnish at least a fairly accurate measure.

2. The correlation between an individual's station in a group

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[1] The numbers in parenthesis refer to the title by the same number in the appended bibliography.

in successive stages of practice and with different forms of discrimination. At what point, if ever, in practice does an individual's station become constant, and how does this point vary with different forms of discrimination? This is the problem of the effects of equal practice on individual differences, on which evidence is very meagre.

3. The nature of the change that takes place when discrimination is improved by practice and the factors that account for the improvement.

4. The common factors that may be involved in different forms of discrimination which might bring about an increase in correlation.

The subject of sensory correlation has only in recent years received the attention it merits. Although many psychologists have recognized the importance of the problem and have made it the object of experimental inquiry, very few have been at all satisfied with their results. In fact, there has scarcely been a statement made concerning sensory correlation that has not been seriously questioned by other investigators in the field. The extremists, on the one side, maintain that the correlation between different sensory abilities is high and that the correlation between sensory discrimination and general intelligence is very high, or, perfect; while others maintain that there is little or no correlation. Between these two extremes we find all degrees of variation.

II. *Description of Experimental Work*

A. Tests—General Description. The experimental work of this investigation is concerned with four forms of sensory discrimination,—the Discrimination of Pressure, of Length of Lines, Auditory Discrimination, and Brightness Discrimination. Each test was carried on for ten consecutive days and as nearly as possible at the same period of the day. There were fifty judgments to be given in each day's test, or five hundred judgments for each type of discrimination, so that in the four tests two thousand judgments were given by each subject. The eight subjects made, in all, sixteen thousand judgments. The method of right and wrong cases was used throughout and the order of stimulation in each test was determined by chance. These four tests were used partly because of the fact that previously published results have dealt with these forms of discrimination and partly because of the readiness with which they lend themselves to the measurement by the method of right and wrong cases.

B. Order of Tests. The four tests were given in the following order to all subjects:

1. Discrimination of Pressure.
2. Discrimination of Length of Lines.
3. Auditory Discrimination.
4. Brightness Discrimination.

This order was adhered to strictly for the reason that the various tests given to the different subjects would be made under the same conditions as far as the effects of practice were concerned. It was not in the province of this study to deal with the transfer of practice.

C. Subjects of the Experiment. Eight individuals were chosen, varying in age from seventeen to forty years of age, with different degrees of training, experience and interests. All subjects, however, had as a minimum the high school grade work. Two subjects were in the graduate department of Educational Psychology; one an instructor in Psychology; one a senior in the Literature and Science Course; one Junior; two Sophomores; and one Freshman in the College of Agriculture. One of the Sophomores and the one Freshman were mature men, the Sophomore being a man of twenty-nine years of age, a graduate of a Normal School and having been a superintendent of schools for four years. The Freshman was a man of twenty-four years of age and had taught in a city school system for three years. The Junior and the other Sophomore were average University students in the College of Agriculture.

The first four subjects named were men of wide experience both in teaching or educational training and in the laboratory work of Educational Psychology.

The interest of all the subjects was exceedingly good, and every effort was made to make the tests accurate. There was a decided effort, at all times, to make as high a record as possible. The writer, in most instances, gave a brief description of the purpose of the experiments in order that there would be an interest aroused by the subjects in their results. This type of motivation functioned exceedingly well and helped to stimulate each subject to his maximum effort in each test.

D. Description of the Apparatus and Methods Used. A brief description of each test will be outlined below:

a. Discrimination of Pressure

In this test Whipple's Pressure-Pain Balance was used with a weight of 200 grams at the outer end of the lever and an increment weight of 20 grams. Each subject took a comfortable position—the instrument being so placed that the subject's wrist came just over the edge of the table. The hand could then lie upon the hand rest, with the end of the forefinger projecting straight forward between the two tips of the balance. The upper tip was so arranged as to come in permanent contact with the center of the finger nail. The subject closed his eyes; at the word "Now," the first stimulus was given and two seconds later the second one was given. The subject was required to state, in terms of the latter, whether it was heavier or lighter. Every effort was exerted by the experimenter to make the two stimulations of the same duration and the same degree of application. Occasionally the writer would stop and allow the subject to remove his finger for a short period, perhaps fifteen or twenty seconds, as many subjects felt a sort of numbness after a number of stimulations had been given.

b. Discrimination of the Length of Lines

For the discrimination of length of lines eight cards, on which were engraved lines 20 and 20.3 mm., were exposed, by means of the Jastrow memory apparatus. The cards were so arranged in series that the chance order of presentation was maintained.

The subject was seated before the apparatus in such a manner that his eyes were on a level with the lines. Then a pair of lines were exposed for two seconds, the record of the time being kept with a metronome, beating seconds. The subject was required to judge whether the right line was longer than the left throughout one whole test. Then, in the following day's test, the subject was required to judge the left in terms of the right, and so alternating throughout the ten tests.

c. Auditory Discrimination.

Seashore's audiometer was used for the tests in Auditory Discrimination (11). A room was chosen which would be as free from noise as possible. The subjects were instructed to make use of their keener ear. All of the subjects, however, were normal in the point of hearing. One stimulus was placed at 28 and the other at 29 on the scale of the audiometer. The stimuli were given in chance order, care being taken to make the tests of the same duration. The subject assumed a comfortable position, closed his eyes and kept them closed throughout the experiment. The judgments were given first in terms of the first stimulus, then, in terms of the second.

d. Brightness Discrimination.

Whipple's apparatus for brightness discrimination was used for the tests in brightness discrimination (11). The apparatus is a box fitted with a high-power frosted Tungsten lamp, the light of which is reflected from two independently adjustable white screens upon two oblong translucent windows, so placed in the face of the box as to give out as nearly as possible the same amount of light when the levers are set even on the scale.

The apparatus was set up in a dark room and in such a position that the subjects' eyes came even with the apertures. The levers regulating the reflectors were placed even at first in order to regulate the position of the apparatus so that the lights of the two would appear equal in intensity to the subjects. One lever was then set at 120° and the other at 115°. The order of brightness in the two windows was one of chance. The subject was required to judge whether the right was darker or lighter than the left in one test, and the left in terms of the right in the next, and so on, alternating each test. Between tests the subject closed his eyes and kept them closed until the writer gave the signal, "ready."

III. *Results and Discussion of the Experiments with the Several Groups of Tests*

The gross results of the various tests are indicated in Table I. This gives the per cent of right cases in the four tests for the eight subjects, together with the averages and mean variations.

TABLE I

Subjects	Daily Tests	Pressure	Lines	Sound	Brightness
1	1	70	72	74	74
	2	72	74	76	78
	3	78	76	82	80
	4	76	78	84	84
	5	84	84	88	88
	6	88	82	90	92
	7	90	82	90	92
	8	94	84	92	92
	9	94	88	88	88
	10	98	88	94	94
	Av.	84.4±8.3	80.8±4.6	85.8±5.4	86.2±5.6

TABLE I—*Continued*

Subjects	Daily Tests	Pressure	Lines	Sound	Brightness
2	1	64	66	76	72
	2	68	74	80	80
	3	78	80	82	84
	4	66	76	82	86
	5	84	78	80	82
	6	82	80	88	86
	7	82	82	86	88
	8	84	80	88	90
	9	86	80	88	90
	10	80	86	86	88
	Av.	77.4±6.8	78.2±3.7	83.6±3.6	84.6±4.0
3	1	56	68	88	88
	2	64	72	86	90
	3	64	82	86	92
	4	78	86	82	92
	5	80	90	84	94
	6	84	84	88	94
	7	86	86	90	94
	8	82	90	88	90
	9	86	92	86	90
	10	84	84	92	94
	Av.	76.4±9.0	83.4±5.6	87.0±2.2	91.8±1.8
4	1	74	68	74	68
	2	76	70	76	70
	3	78	74	82	74
	4	84	70	78	72
	5	78	70	80	84
	6	80	76	84	80
	7	84	82	86	86
	8	82	80	88	88
	9	92	84	88	92
	10	90	88	84	90
	Av.	81.8±4.5	76.2±5.8	82.0±4.0	80.4±7.6
5	1	70	68	70	72
	2	62	66	68	78
	3	72	74	74	74
	4	84	82	80	84
	5	82	84	86	86
	6	86	88	84	84
	7	82	80	88	90
	8	88	86	94	96
	9	90	86	90	94
	10	96	90	96	96
	Av.	81.2±7.9	80.4±6.7	83.0±8.0	85.4±7.0

TABLE I—*Continued*

Subjects	Daily Tests	Pressure	Lines	Sound	Brightness
	1	70	70	76	82
	2	72	76	82	88
	3	76	74	86	90
	4	80	84	82	92
	5	90	80	84	88
6	6	90	86	88	92
	7	84	80	84	92
	8	88	82	88	94
	9	86	92	88	90
	10	88	94	92	94
	Av.	82.4±6.3	81.8±5.8	85.0±3.4	90.2±2.5
	1	76	74	76	76
	2	80	72	82	88
	3	82	78	74	86
	4	78	76	74	90
	5	84	80	88	88
7	6	90	80	90	92
	7	90	80	92	94
	8	90	82	90	90
	9	92	86	88	92
	10	92	88	92	92
	Av.	85.4±5.4	79.6±3.6	84.6±6.4	88.8±3.4
	1	68	70	78	84
	2	76	80	80	90
	3	88	82	82	94
	4	86	90	84	96
	5	84	86	88	96
8	6	86	92	90	94
	7	86	92	88	96
	8	92	84	94	98
	9	92	90	92	96
	10	98	98	96	98
	Av.	85.6±5.7	86.4±6.0	87.2±4.9	94.2±2.9

The following coefficients of correlation are calculated by the rank method developed by Spearman and also by the product-moment method of the Pearson-Bravais Formula.

TABLE II

Coefficients of Correlation of the Different Sensory Tests

	Spearman	Pearson
Lines and Sound Discrimination.................	+.90	.92
Brightness and Sound..........................	+.90	.96
Pressure and Lines............................	+.39	.20
Pressure and Sound............................	+.36	.13
Lines and Brightness..........................	+.92	.92
Pressure and Brightness.......................	+.41	.20

The most striking result revealed by the experiments consists in the very high correlations shown between the ranks based on the averages in all of the tests and particularly between sound, brightness and line discrimination. The correlations are very much higher than those reported by previous authors. A comparison with Burt's results shows this very clearly. He found correlations for discrimination as follows:

	Average
Touch and Weight	+.49
Touch and Pitch	+.12
Touch and Length	+.23
Weight and Pitch	+.29
Weight and Length	+.00
Pitch and Length	+.09

Thorndike similarly finds a loose correlation between different forms of discrimination. Moreover, not only are the correlations for different sensitivities low or absent entirely, but even the correlation between drawing a line to equal a 100 mm. line and one equal to a 50 mm. line is only +.77. The results in other words point not only to a high degree of independence of different forms of discrimination but also of any single form with varying data or content. My own results, however, show very close interrelations between the different sensory abilities when a sufficiently large number of experiments is made to furnish an adequate measure of an individual's capacity. Most of the investigations previously made, from which the conclusion has been drawn that the "sensitivities interrelate very loosely," have been based on one or a few experiments with large groups. The reliability of the coefficients is, therefore, low. Certainly when the ranks in any tests are based on ten series of experiments, each involving fifty judgments, there is no question that the coefficients are very high and the reliability great. The only departure is in the correlations with pressure discrimination. The experiments on pressure, however, are the least reliable because of certain sources of inaccuracy in the administration of the tests by the experimenter. With the particular type of instrument employed it is difficult to maintain constancy in the duration of the stimulus and to maintain a uniform rate of application of the stimulus, and, consequently, to avoid variations in amount of pressure. Moreover, the constant error arising when the lighter stimulus comes after the heavier affected the results with some subjects, notably subject 4 who gave but 2 erroneous judgments out of 250, when the heavier stimulus followed the lighter. A further factor in reducing the coefficients is the fact that one subject ranked 8 in pressure discrimination and 2 in all the other tests. With the rank method of correlation the differences of rank, 6 in each pair of correlations, reduced each of the coefficients .42. With a larger number of cases this factor in reduction would be less effective. The correlations with the 7 subjects for pressure with length of lines is .61, with sound .75, with brightness .74.

The coefficients by the Pearson method were calculated for purposes of comparison with those of the rank method. The differences resulting are, in some cases, very marked. An inspection of the actual results in the tests suggests that neither method gives an adequate expression of the amount of correlation. The Pearson method tends to give undue weight to the extreme deviations from the average, while, on the other hand, the rank method gives undue weight to small differences.

The highest correlation is between discriminations of length and of brightness. This might, perhaps, be attributable to the fact that the same sense organ is involved. The correlations indicate that the subjects who had difficulty in discriminating brightness also had difficulty in discriminating length. Moreover, the correlations between brightness and length discriminations with the other forms are very similar.

Length with Sound Discrimination	+.90
Brightness with Sound Discrimination	+.90
Length with Pressure Discrimination	+.39
Brightness with Pressure Discrimination	+.41

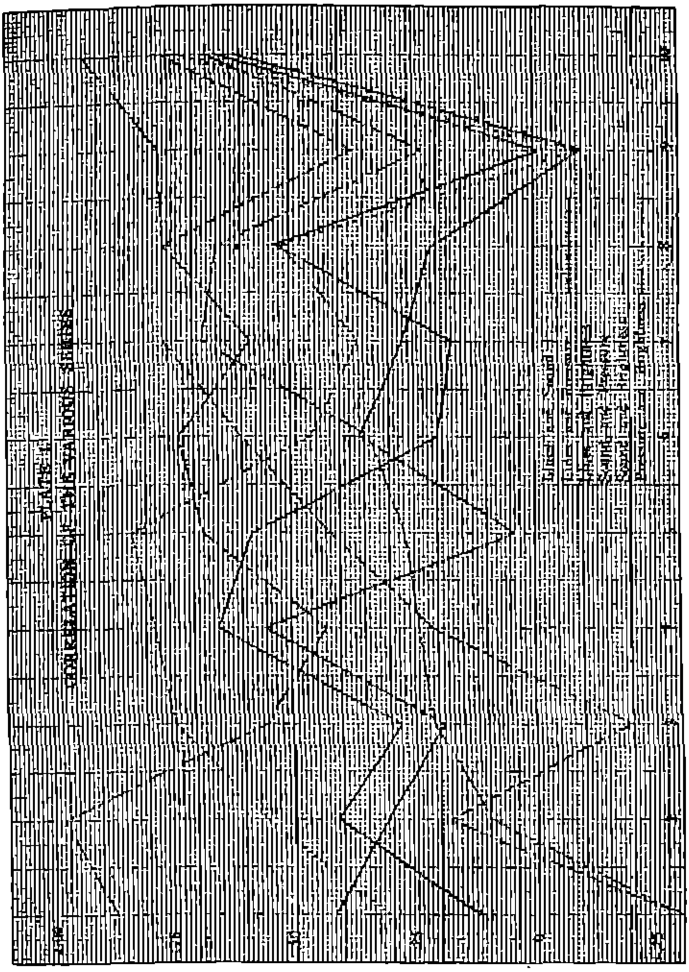
However, the correlations between sound discrimination and discrimination of length or brightness are almost as close as the correlation between brightness and length. Some other underlying factor must have been involved. The explanation of the high correlations obtained between the different forms of sensory discrimination studied seems to demand a modification of the extreme view of specialization and independent variability of mental functions of which Thorndike has been the chief defender. Some intermediate position between that taken by Thorndike and the one maintained by Spearman is suggested. In the face of these results, one could scarcely hold that the different forms of discrimination interrelate loosely. Interrelation is close but by no means perfect. Moreover, two of the factors which might cause high correlations have been eliminated as far as possible; namely, variation in the conscientiousness and good will of the subject, and variation in the amounts of practice. If, in a group of subjects, some were conscientious observers and others not, the ranks might give an appearance of correlation, but this correlation is in conscientiousness and not in discrimination. Again, if in a group the subjects tested started at different stages of practice and training, the result might, on a basis of ranks, either give a high correlation or a low correlation, but the coefficient would not then measure sensory discrimination, but something else. With these factors eliminated, we are reduced to some other common factor or factors which might be operative. Spearman's hypothetical "Central Factor" is suggested, but it is obscure and mysterious. To appeal to it is but to cloak our ignorance. An extension of this investigation with a further analysis of the factors involved is contemplated. Until such results are at hand, a definite attempt at explanation will not be ventured by the writer.

One of the purposes of this investigation was to study the correlations shown at different stages of practice. From the point of view of method in mental tests it is important to determine the number of tests necessary to give a reasonably accurate coefficient of correlation. Moreover, such a study would throw light on the course of practice itself. Theoretically, one might expect, since the real effect of practice is to reduce variability, that the coefficient of correlation in successive stages of practice would become high. This would be true however only on the supposition that practice took much the same course in different individuals, and that the effects of practice on different individuals, and with different forms of discrimination were equal. The results of correlation based on the averages of the first two, the fifth and sixth, and the last two tests, appear in Table III. The results of Table III are graphically represented in Plate I.

TABLE III

Correlation Based on First Two, Fifth and Sixth, Eighth and Tenth, and Last Two Tests

Series	1 and 2,	5 and 6,	9 and 10,	8 and 10
Lines and Sound	.56	.55	.77	.96
Lines and Pressure	.11	.16	.48	.58
Lines and Brightness	.64	.84	.78	.93
Sound and Pressure	.00	.70	.77	.82
Sound and Brightness	.93	.83	.77	.90
Brightness and Pressure	—.18	.41	.44	.68
Average	.40	.58	.67	.81



There is a general increase in the coefficients but the increase is not very marked, partly due to an unaccountable fluctuation in the ninth step of experiments. The correlations with each of the ten series of tests appear in Table IV.

The effects of practice in the different tests are indicated in the plates. In every case, there is a marked improvement. The course of practice is similar with the different individuals and with the different forms of discrimination. Practice

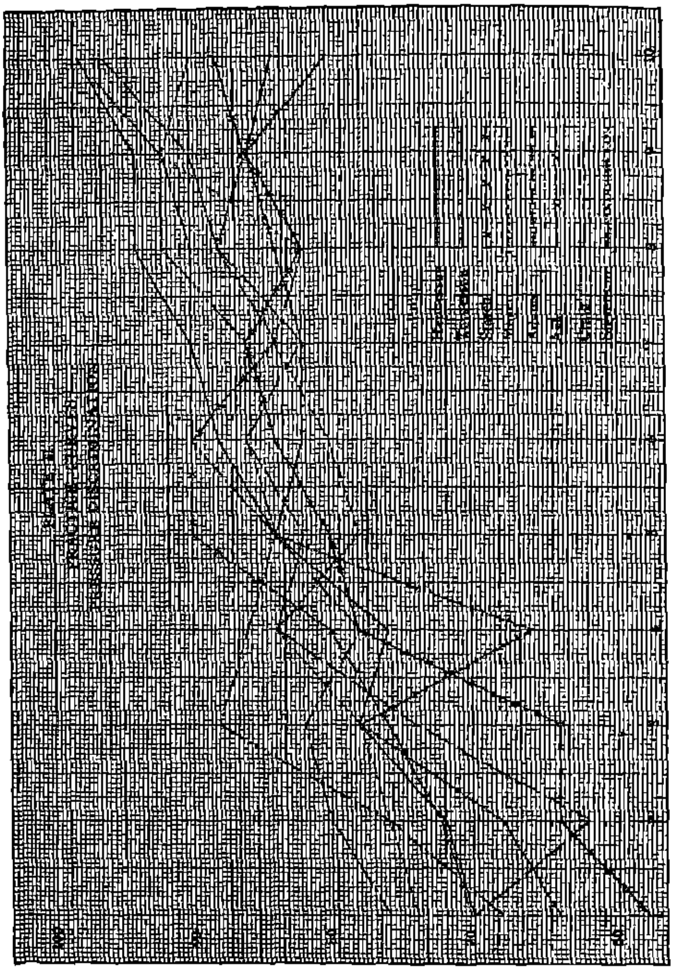


Table IV

Table of the Coefficients of Correlation of the Ten Series of Sensory Tests

Series	1	2	3	4	5	6	7	8	9	10	Av.
Lines and Sound.......	.12	.41	.28	.65	.58	.20	.17	.53	.01	.65	.37
Lines and Pressure.....	.42	.31	.19	.55	.04	.36	.27	—.21	.10	.61	.31
Lines and Brightness...	.31	.56	.74	.78	.83	.46	.36	.52	.10	.72	.54
Sound and Pressure....	.30	.18	.20	.21	.42	.60	.76	.76	.37	.76	.46
Sound and Brightness..	.87	.98	.55	.43	.68	.73	.58	.76	.77	.93	.73
Brightness and Pressure	.30	.10	.21	.24	.27	.34	.68	.65	.23	.67	.37
	.39	.42	.35	.48	.47	.45	.47	.57	.26	.72	

effect is most marked in the discrimination of pressure, and the increase is gradual.

IV. *Conclusions*

The results of this investigation seem to justify the following conclusions:

1. The correlations between different forms of sensory discrimination are, in every case, positive and usually very high. The range is from .39 to .93. When correction is made for accidental variations, the range is from .71 to .93. These coefficients justify a modification of present-day opinion with regard to the independence of different sensory abilities.

2. The effect of practice is to increase the coefficients. This was shown by calculating the coefficients from the first two, fifth and sixth, and last two tests, and by calculating the coefficients for each of the ten series of experiments.

The coefficients fluctuate considerably, and there appears to be no point in the course of practice where an individual's station in the group becomes relatively constant.

3. The correlations are highest between brightness and length discrimination, but they are practically as high between sound discrimination and brightness or length.

4. Pressure discrimination correlates least with the other tests. Certain unavoidable sources of inaccuracy in making experiments account in considerable part for this fact.

5. The effect of practice is similar in the different tests and with different individuals.

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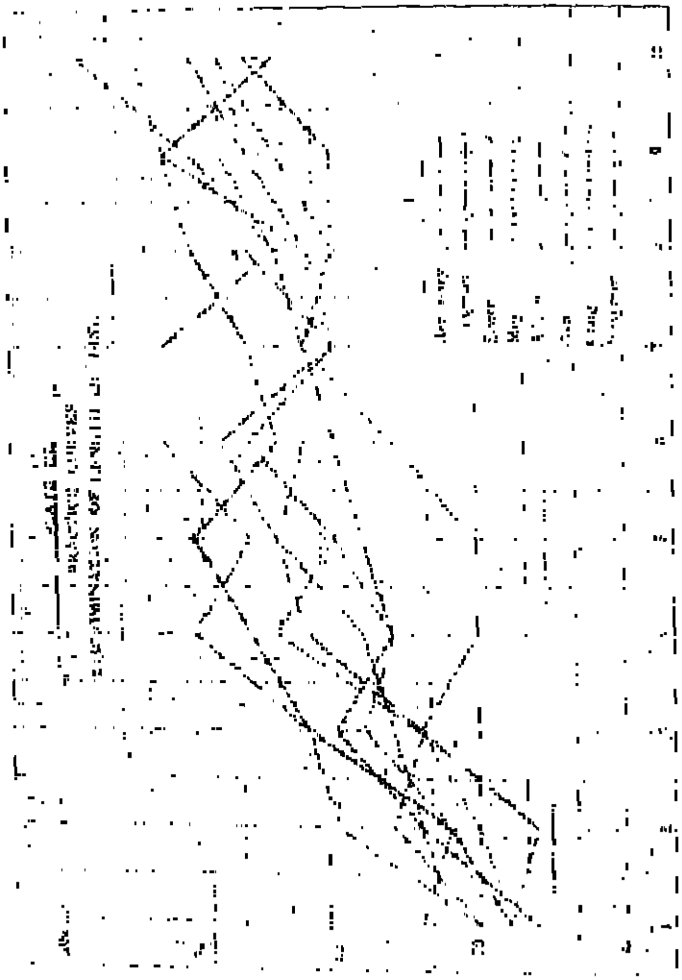

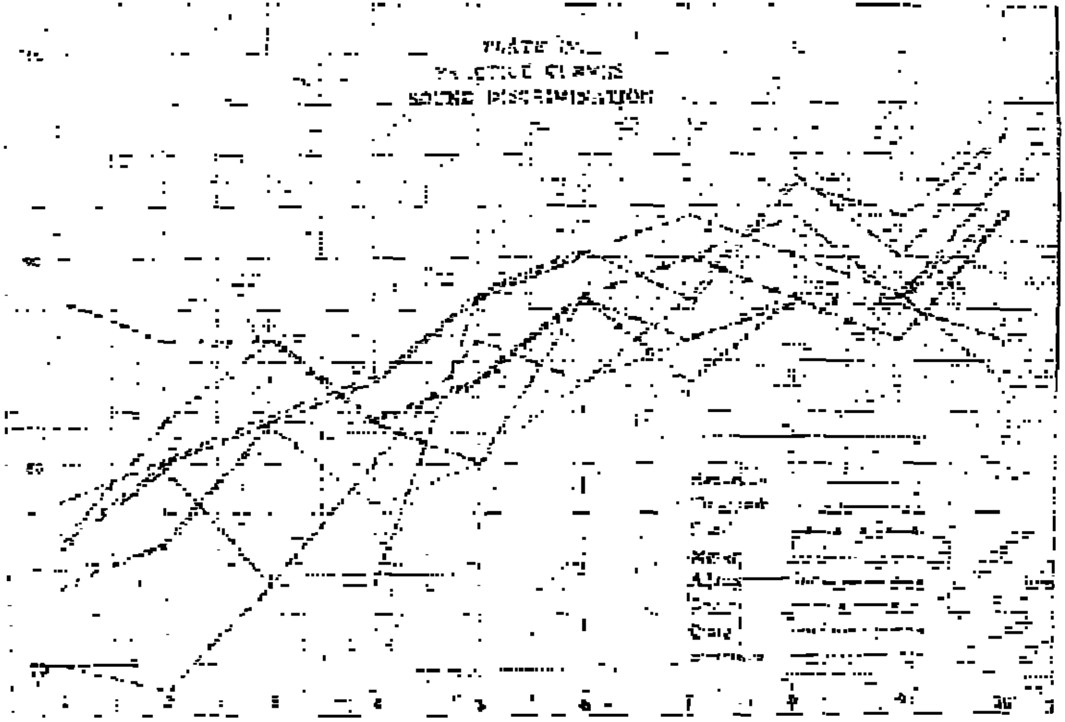
PLATE IX.
PRACTICE CURVES
SOUND DISCRIMINATION

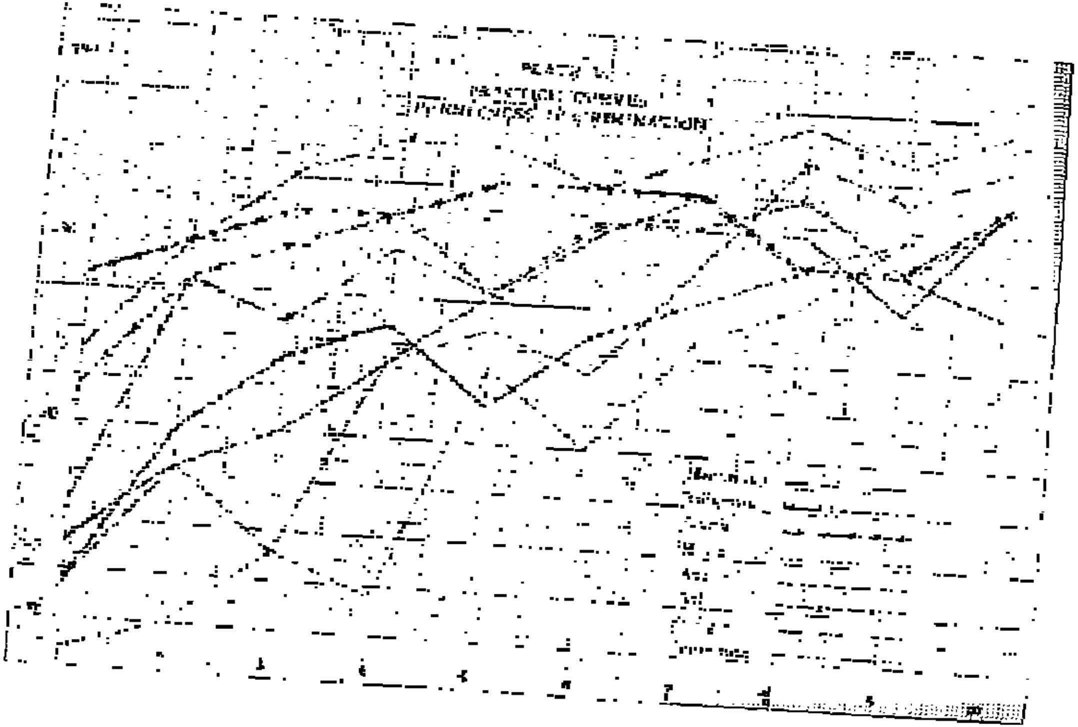
PLATE V.
PRACTICE CURVES

A SCALE OF INTELLIGENCE OF COLLEGE STUDENTS FOR THE USE OF COLLEGE APPOINTMENT COMMITTEES[1]

By R. P. Jarrett

Applied psychology has a great influence in various lines of endeavor today. The aid of the psychologist is secured by large corporations in order to reduce expenses in employing new salesmen. The government of the United States seeks his help in testing the general mental ability of the foreigner when he comes to this country. The psychologists of this country are doing their bit in the present crisis by attempting to classify the soldiers so that promotion can be made on a proper basis. It seems reasonable, therefore, to suppose that students of colleges and universities could be classified on the basis of their probable success in life in such a way that the appointment committee would be more able to do effective work.

With this idea in mind, the writer, under the direction of Professor Edward K. Strong, Jr., made a study during the spring and summer of 1917 of the subject; "How to secure the most reliable rating of students by members of the faculty for purposes of the appointment committee." This study[2] was divided into three sections: (1) methods used by the appointment committees of colleges, universities, and normal schools for the purpose under consideration; (2) the relation of mental tests to college grades, faculty rating, and value of position held by the students after leaving college; and (3) the development of a scale of intelligence by Peabody students. This paper refers to the last section of the general study.

In the first section of the study it was found that a few institutions of higher learning in the United States have the members of the faculty rank the students who are in their classes. None of the schools replying to our questionnaire have a comparative ranking of those seeking the services of the appointment committee by which all are compared together on the same basis. The rankings, moreover, in the various classes do not seem to be scientifically based upon the various elements that have to do with success in life. In fact, the members of the faculty do not seem to have any concrete basis upon which to make their judgments. In no case do we find any sort of scale for the use of the members of the faculty in making their judgments.

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[1] From the Psychological Laboratory of George Peabody College for Teachers.

[2] An unpublished thesis by this title in the college library.

In order to get a comparative ranking that is of greatest value, it should be based upon several important principles. (1) The judgments should be made upon the various elements that make for success in life. (2) The judgments should be made with a well-developed scale as a basis. (3) The combined judgments of several competent persons should be secured, the greater the number the better. (4) Provision should be made for omitting the extreme judgments, for in all probability they are the results of undue influences.

During the school year 1915-1916, Dr. Strong had one-hundred students of George Peabody College for Teachers ranked from one to one-hundred. With this as a basis, he devised a scale of ten equal steps. The distribution was made on the basis of the standard deviation. The names of several students were then placed in each of these steps, the ranking enabling him to select the proper names for each step. The name of each student registered in Peabody College was placed on separate slips of paper. Fourteen members of the faculty of Peabody College then placed the name of each student registered in the institution in the step of the scale in which he thought it belonged. This gave a comparative ranking of all the students based upon the preliminary scale.

Under Dr. Strong's direction, several names were then taken from each step in the general distribution of Peabody students who were ranked by the fourteen members of the faculty. This gave a scale of nine steps on basis of P. E., ranging from — 4.00 P. E. to + 3.50 P. E., the steps representing 1 P. E., with the exception of the step between group 1 (+ 3.50 P. E.) and group 2 (+ 3.00 P. E.) which was equal to only 0.50 P. E. The general distribution and formation of the scale is shown by the following table or diagram:

SCALE OF GENERAL INTELLIGENCE OF PEABODY STUDENTS
(Group 1: most intelligent. Group 9: least intelligent. Group 5: average.)

					m w		w		
					m w		w		
	*w			w	m w		w		
	w		m w	m w	m w	w	m w		
	w	†m w	m w	m w	m w	w	m w	w	
	w	m w	m w	m w	m w	m w	m w	m w	m
	w	m w	m w	m w	m w	m w	m w	m w	m
	5	6	8	9	14	6	11	5	2
Group……	IX	VIII	VII	VI	V	IV	III	II	I
P.E………	—4.0	—3.0	—2.0	—1.0	—0.0	+1.0	+2.0	+3.0	+3.5

* Women. † Men.

Through the aid of the chairman of the appointment committee of the College each member of the faculty was sent a letter, a copy of the new scale, and a list of the students registered in George Peabody College for Teachers during the school year 1916-1917. The letter explained the formation of the scale and asked that a rating be made of the students whom the instructor knew (through class work or in a personal way). Ratings were to be in terms of *General Intelligence,* and all characteristics of the individual making toward success in life were to be considered.

The scale was sent to the faculty in the following form. For obvious reasons, the names of the students cannot be placed here.

Scale of General Intelligence of Peabody Students

(Group 1: most intelligent. Group 9: least intelligent. Group 5: average.)

Group 1		Group 4		Group 7	
			w 14	m 22	w 30
			w 15	m 23	w 31
m 1	w 1	m 9	w 16	m 24	w 32
m 2	w 2	m 10	w 17	m 25	w 33
Group 2		**Group 5**		**Group 8**	
		m 11	w 18		
		m 12	w 19		
		m 13	w 20		
	w 3	m 14	w 21		
	w 4	m 15	w 22	m 26	w 34
m 3	w 5	m 16	w 23	m 27	w 35
m 4	w 6	m 17	w 24	m 28	w 36
Group 3		**Group 6**		**Group 9**	
	w 7				
	w 8				
	w 9		w 25		w 37
m 5	w 10	m 18	w 26		w 38
m 6	w 11	m 19	w 27		w 39
m 7	w 12	m 20	w 28		w 40
m 8	w 13	m 21	w 29		w 41

Sixteen members of the faculty made the rating called for. One new addition to the faculty was unable to make a report on account of the fact that he did not know most of the people placed in the scale. As a rule, those students who were here only a short time during the fall quarter were not rated by many members of the faculty. The following table indicates the general distribution of the number of ratings received by the different students.

NUMBER OF STUDENTS; AND NUMBER OF RATINGS GIVEN

Entire number of students	493
Number rated thirteen times	1
Number rated twelve times	2
Number rated eleven times	11
Number rated ten times	13
Number rated nine times	18
Number rated eight times	19
Number rated seven times	24
Number rated six times	44
Number rated five times	55
Number rated four times	45
Number rated three times	58
Number rated two times	62
Number rated one time	75
Number not rated	68

It is believed that a rating based upon the combined judgments of a great many competent judges is better than a rating based upon the judgments of a few competent judges. But on account of the fact that many of the students in George Peabody College for Teachers come in contact with no more than four teachers, it has been necessary to consider four ratings as sufficient in getting the general distribution of intelligence of Peabody students.

In order to guard against prejudice, the highest and the lowest ratings are discarded. The average of the remaining ratings is taken as the rating of the individual.

The general distribution of intelligence of Peabody students is indicated in the following table.

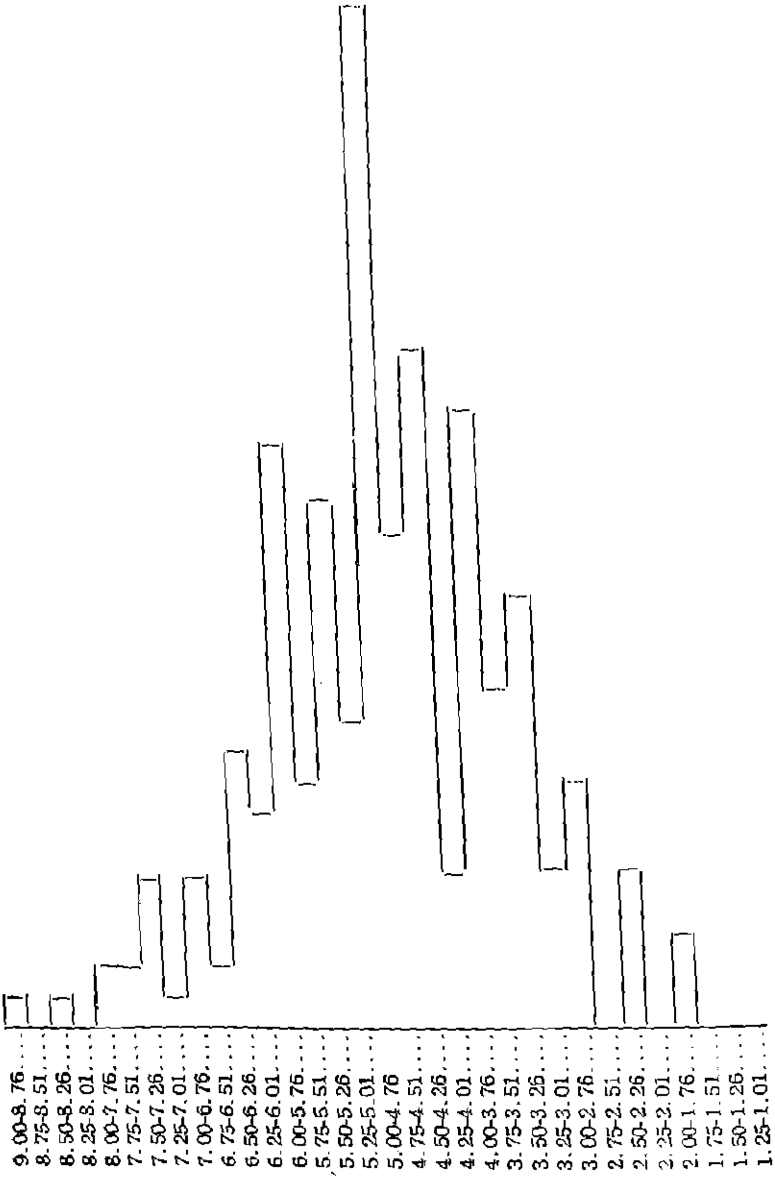
DISTRIBUTION OF INTELLIGENCE OF PEABODY STUDENTS

P.E.	Rating	Number receiving rating
+4.00	....	0
	1.00-1.25	0
	1.26-1.50	0
	1.51-1.75	0
+3.00	1.76-2.00	3
	2.01-2.25	0
	2.26-2.50	5
	2.51-2.75	0
+2.00	2.76-3.00	8
	3.01-3.25	5
	3.26-3.50	14
	3.51-3.75	11
+1.00	3.76-4.00	20
	4.01-4.25	5
	4.26-4.50	22
	4.51-4.75	16

DISTRIBUTION OF INTELLIGENCE OF PEABODY STUDENTS—*Continued*

P. E.	*Rating*	Number receiving rating
0.00	4.76-5.00	32
	5.01-5.25	10
	5.26-5.50	17
	5.51-5.75	8
—1.00	5.76-6.00	19
	6.01-6.25	7
	6.26-6.50	9
	6.51-6.75	2
—2.00	6.76-7.00	5
	7.01-7.25	1
	7.26-7.50	5
	7.51-7.75	2
—3.00	7.76-8.00	2
	8.01-8.25	0
	8.26-8.50	1
	8.51-8.75	0
—4.00	8.76-9.00	1

The general relation of the various elements of this distribution will be more apparent by plotting a curve of the distribution. This is shown by the following plate.



Distribution of Intelligence of Peabody Students

The distribution is very near a normal curve. No student is rated higher than step 2 of the scale, while only two students are placed lower than step 8 of the scale, one of those being placed as low as step 9. This general condition is to be expected, for if one teacher, not including the two ratings excluded to guard against prejudice, should give an individual a rating lower than one, his final rating could not be that high. This is correspondingly so, of course, for group 9. There are many fluctuations in the several groups of the distribution, but this is to be expected on account of the small number of individuals considered. Also, dividing the steps into four divisions tends to make the distribution irregular.

As has been said, the general character of the distribution is as near a normal curve as could be expected. The mode is the 4.76-5.00 group, and the median of the distribution falls within this group. One hundred and nine ratings fall above the mode, and eighty-nine fall below it. Only two persons have a rating approximating the ninth step of the scale, and but three persons have a rating within ½ P. E. of the highest step of the scale.

The ratings given in this study should be more reliable than those given by individual members of the faculty, for the combined judgments of several people should be of greater value than that given by one person. Also, the fact that the extreme rankings were thrown out should tend to make the final results more reliable, for the extremes are likely to be influenced, for or against, by factors that do not indicate the real strength of the individual. The fact that those making the ratings had a scale before them should tend to result in more accurate ratings, because the traits of one person could be judged better by having a measure or scale than they could be without any concrete basis upon which to make the ratings. The fact that the scale was made to conform to the judgments of several persons, and that representative persons in each group were taken for each division or step of the final scale, should tend to aid those making the rating.

The development of a scale of this character, and the ratings by several persons, each having in mind the various elements that make for success in life, make it possible to get ratings that do not have the faults found in an individual rating. Under present conditions, the influence of scholarship is stressed too much, the reports are often too lax, etc. The use of the scale prevents to a large degree the effect of such elements as these.

The first section of the general study i.e., concerning methods now in use by appointment committees revealed the fact that only small groups, members of classes, were rated, and as a result the appointment committee might be called upon to choose between two individuals who were not considered in the same rating. Under this condition there would be no way to compare accurately the two individuals. The plan given here places in the hands of the appointment committee the comparative ratings of all students registered with the committee.

The plan should be of greater value than the methods now in use, because the individual is rated in terms of his total efficiency rather than upon certain particular characteristics. As we do not know the value of specific characteristics nor how to combine them into a sum total, a grading upon general intelligence is certainly safer today.

The next question that arises is, Can the scale be used successfully from year to year? The following facts indicate that the scale can be revised easily and that it should become more accurate with each revision. (1) The names placed on the scale are well known by the members of the faculty, and for this reason they can be used successfully for two or three years. (2) New names can be placed in the scale from year to year, because each year all of the students will be rated on the basis of the scale and representative students from each group can be placed in the scale and the names of those who have been away from the college more than one or two years can be taken out of the scale. Suppose the first man used in step 3 of the scale has been away two years in 1919, and for this reason the members of the faculty do not remember his characteristics so well as they do those who were in school the previous year. Step 3 in the general distribution for the previous year would have the names of several men. These could be placed in the scale and the names of those who have been away from the college for two or three years could be dropped.

The following conclusions seem to be justified:

1. The scale should become more accurate, for the reason that the record of those who secure positions can be obtained and this can be studied in connection with their ratings.

2. The use of the scale should meet the approval of the members of the faculty, because it will not require more than thirty minutes for each teacher to make the ratings of all the students he knows in the institution.

3. It is true that some of the names in the scale will not be placed in the proper position so far as the individual opinion

of the instructor is concerned, but he should recognize the fact that the combined judgments of several persons should be more reliable than his judgment. The fact that he rates the student in terms of the scale makes it possible for him to prevent the undue influence of any prejudice that he may have in regard to the individual.

4. The use of the scale will enable the appointment committee, in later years, to find the correlations between what the person does in the field, his rating on the basis of the scale, and the record he makes in mental tests.

5. Finally, the rating of the individual should not be considered the *total basis for appointment. It should be supplementary* to the information that the committee receives on the blanks now in use and from the record the person makes in the mental tests. In other words, the report of the instructor gives his individual opinion, the tests show the general mental ability of the student, and the rating gives the combined judgments of several competent persons and is based upon a scale that has been carefully developed with due consideration to all of the elements that make for success in life.

A CONTRIBUTION TO THE STUDY OF INSTRUMENTAL MUSIC

By Samuel E. Pond, A.M., Clark University

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I. *Introduction*

This investigation aims to make a contribution which may be of service in mastering the technique of musical instruments, and especially of the French horn. The study was undertaken with a view to discovering the causes of difficulty in executing certain passages; but as the work progressed it became evident that the means which we employed for isolating the troublesome factors might be of service in improving the player's technique. The investigation in its final form aimed to throw light upon the following questions: What are the essential characteristics of the behavior involved in the mastering of a musical instrument? What mental processes play a part in directing the player's activity? In what order do these mental processes make their appearance? Does the turning of one's attention to these mental processes furnish a means for improving the player's technique? Numerous other problems have been raised during the course of the investigation, but we are concerned here only with those which are fundamental to the overcoming of the chief difficulties which are discussed in this paper.[1]

---

[1] This investigation has been carried on simultaneously with the laboratory course in experimental psychology at Clark University during the years 1915-17; earlier observations were made (1914) which suggested the need for intensive study. The author is indebted to the members of the department for criticism and suggestions; he

The French horn belongs to the brass-wind group, and it is utilized by the larger orchestras. The instrument consists essentially of a tapering tube, about eight feet long and coiled three and a half times; it has a flaring bell at one end of this tube, and a small conical mouthpiece at the other end.[2]

The pitch of the tone emitted by this instrument is varied and controlled by three devices: (1) The instrument is provided with three valves, the opening of which has the effect of increasing the length of the tube. That is, they lower the pitch of the tone; and the amount of lowering by means of this device may reach a maximum of six semi-tones. (2) By partially closing the flaring bell with the right hand at the end of the tube, the player is able to lower the pitch. The amount of lowering depends upon the amount of closure, the maximum lowering which is possible by this means amounting to three semi-tones. (3) The means which is most frequently employed, however, consists in manipulating the lips. By varying the tension of his lips,—and by thus varying the vibration frequency of the blast of air emitted through them,—the player finds it possible to raise or to lower the pitch of the tone produced by the instrument. This lip-manipulation enables him to produce tones varying from b of the contra octave[3] (62 vibrations per second) to a of the twice-accented octave (880 vibrations),—a range of four octaves less one semitone.

Certain tones may be produced without resorting to the use of the valves. These are known as open tones; there are fifteen of them, and their pitch varies from 88 vibrations to 880 vibrations. The other tones of the instrument are produced either by the use of the valves or by partially closing the aperture of the flaring bell by inserting the hand. For instance, any open tone may be lowered by a semi-tone either by opening the second valve or by closing approximately half of the opening of the bell; open tones may be lowered by two semi-tones either by opening the first valve or by shutting off about three-quarters of the bell; and open tones may be

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is also indebted to Dr. E. L. Davis (hornist), Mr. Franz Hain (hornist) and Mr. R. Nagel (cellist) of the Boston Symphony Orchestra, and to the writer's father, Mr. Frank S. Pond (cornetist).

[2] The French horn is provided with nine or more set-pieces,—'crooks' and mouthpiece extensions; when inserted at its appropriate place either in one of the coils or at the mouth-aperture, each of these set-pieces changes the pitch of the tone produced by a definite amount. These set pieces are employed only in ensemble playing.

[3] These pitches are expressed in terms of the notation of the piano scale.

lowered by three semi-tones either by opening the third valve, by a combined use of the first and second valves, or by shutting off the bell almost completely. Greater variations from the open tones,—for instance, lowerings amounting to four, five and six semi-tones such as are necessary in playing the chromatic scales of the lower octaves,—can be produced only by various combinations of the valves. These various manipulations, however, affect the quality of the tone produced by the horn; for instance, the open tones and the valve tones have a clear trumpet-like quality, while the shutting of the bell introduces a muffled quality. Hence, whether the valves or the shutting of the bell, or both together, shall be employed for determining the pitch of the tone in any given case depends largely upon the quality of tone desired, upon the accuracy of pitch variation desired, and upon the rapidity with which the passage in question has to be played,—the hand-manipulation required for shutting off the bell demanding an appreciably longer time than the manipulating of the valves.

It is clear from the foregoing statement that there are various difficulties of manipulation which must be mastered by the player of the horn. The wide range of the instrument necessitates a wide range of degrees of contraction of the lip and facial muscles. In consequence of the difficulty involved here the three highest tones and the four lowest tones of the instrument are especially avoided by players. The accurate production of the various tones demands a graduated series of degrees of compression and tension of the lips. A second difficulty in the accurate playing of the horn results from malcoördination of the finger muscles in manipulating the valves; this difficulty, however, is relatively easy to overcome. A third difficulty is involved in mastering the shutting off of the bell; it is exceedingly difficult to adjust the position of the hand with sufficient accuracy to secure exactly the desired variation of pitch and quality. Not only does the producing of any desired tone involve difficulties of technique, but the sustaining and the damping of tones likewise involve peculiar difficulties. A final difficulty has to do with tuning and playing true to pitch.

Throughout the study which is here reported, the writer has served both as experimenter and observer. His musical education has included a brief study of harmony, instrumentation and piano playing. He has had an experience extending over ten years with large and small orchestras, where he has served as trap-drummer. During the last five years he has confined his attention largely to the French horn; and during the past two years he has played a good deal with an orchestra and in a chamber music group. His psychological training has included two years' drill in introspective analysis, in the Psychological Laboratory of Clark University.

II. *Experimental Investigation*

Among the problems selected for investigation were the following: How can one best acquire such a mastery of the instrument as shall enable one to produce any tone accurately and efficiently, to sustain it uniformly, and to damp it promptly and smoothly? We also made a study of the phenomenon of playing out of tune; of the early onset of fatigue; of the memorizing of certain difficult passages; of tuning the horn to other instruments; of the coördinating of finger-movements in operating the valves, especially with rapid chromatics; and of playing the gruppetto (or turn), trills, and slurs.

a. *Preliminary experiments.* Toward the close of the year 1914, at a time when the horn had not been played for several months, the articulation of the tones was found to be distinctly poor.[4] Instead of a clear-cut clang following immediately upon the withdrawal of the tongue from the teeth, there intervened a brief period which was characterized by a wheezing of air. The clang appeared only after an effort involving a straining of the throat muscles and an intensive pressing of the mouthpiece upon the lips. Dr. E. L. Davis had previously suggested that the player should imitate the act of spitting; and the instruction-books recommend the pronouncing of the syllable 'too' or 'tu.' Attention to the movements of the tongue, diaphragm and lips with this idea in mind, led the writer to believe that slow practicing with attention upon the production of the tones would aid in giving rise to a prompt and effective articulation of a clear clang immediately after the tongue was withdrawn. A subsequent criticism by Mr. Franz Hain led the writer to sustain the tones for a considerable period of time, and to attend not only to the attack with the movement and placing of the tongue, but also to the pitch with its variations, to the clearness, and to the damping of the tone. Mr. Hain suggested that the damping of the tone should resemble the tailing-off of the clang of a bell.

b. *General instructions and methods.* Definite periods for introspections were selected, and an order of experimentation was arranged. The practice periods extended throughout the series from eleven to twelve o'clock in the forenoon. Instructions were as follows: "Attend so far as possible to the mental processes involved, noting their quality, duration, intensity, clearness and their sequence. Be careful to note their affective toning. Distinguish throughout between mental image and perception." The introspections were usually recorded by the experimenter himself, but in a few cases they were dictated to an amanuensis. When any process proved to be vague and indefinite, or any verbal expression proved to be unclear, the tests were repeated. The introspective reports were typewritten and filed. On the following day they were reviewed before the same problem was repeated or a new problem was undertaken. Upon the basis of these analyses, simple exercises were arranged; and these latter were practiced at periods other than those used for introspection. The progress and success of the corrective work was studied by applying tests after intervals of several days or weeks.

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[4] The instruction-books which had been used were O. Langey's revised *Tutor for French Horn*, C. Fischer, New York, 1890; and H. Kaufmann's *Album of Twelve Solos*, published by C. Fischer, New York.

c. *Study of the single tone.* i. *Producing the tone.* One tone,—the open d,—offered more difficulty than any other, both in the matter of producing and sustaining. In order to study this difficulty, and if possible to correct it, exercises were undertaken in which the following instructions were employed:

a. Attempt to produce the open d, but stop at the point of releasing the tongue; do not sound the tone. *b.* Sound d at the signal of the metronome bell; introspect on the experiences associated with the producing of the tone from the fore-period until the tone becomes clear. *c.* Sound c; then slur to d; introspect. *d.* Tongue c after striking d; then slur down to d, and introspect on the experience. *e.* Play an exercise of four quarter-notes,—c, d, c, d; tongue each note; play slowly. *f.* Same exercise as *e*, but twice as fast. *g.* Play scale of f major with attention to the production of d ascending, tonguing the whole scale;; introspect especially after tonguing c. *h.* Practice scales half an hour, and then try test *e*. *i.* Slurring exercise, using *e*; follow beats of the metronome (slow movement).

The same exercises were employed with open tones c, d, and g. (These are all produced without the use of valves or hand in the bell.) Our introspections show that the following mental processes are involved in producing a single tone with tongue articulation:

When the mouthpiece was brought to the lips, the player perceived, from cutaneous pressure, that the edge of the mouthpiece pressed more intensively upon his upper lip than upon his lower lip; and he was definitely aware of muscular tension in both of his arms. When he had selected a note to be played, he seemed to hear the note, distinctly and definitely, in the form of auditory imagery. Then he perceived kinaesthetically that the muscles of his lips, chin and cheeks were contracting; he also perceived that he was making a deep inhalation, involving movements of the diaphragm, throat, pharynx and abdomen. And he heard a hissing noise, which was immediately followed by an abrupt relaxation of the muscles of his lips, this temporal relation being conspicuously present to consciousness. The pressure of the mouthpiece upon the lips was again perceived, and simultaneously with it came a kinaesthetic perception of muscular contraction in both forearms and in the left hand. There was also a cutaneous perception of intensive pressure in the little finger of the left hand and in the thumb of the right hand. He now saw that the shadow at the base of the left thumb, between the tendons, was enlarging[5]; and he felt that the tip of his tongue was touching the lower edge of his front teeth. He was aware of changes in the pharynx and of intensive contractions of the diaphragm and abdominal muscles. Muscular tensions were present in the vocal-motor apparatus, especially in the tongue and in the soft palate, followed by a release of the confined air.

The first few introspective reports from exercises *a* and *b* with the open d indicate that the lips were frequently contracted too much, producing e instead of d; or a position was assumed somewhere between d and e, whence the tone would fluctuate ultimately eliding into the final tone. This was accompanied by an experience of disagreeableness, localized in a twitching of the pectoral muscles. The contraction of the lips was frequently preceded by a vocal-motor-auditory experience,—such phrases as 'contract,' 'pull hard,' 'away up.' This was followed by a kinaesthetic perception of a gradual movement of the lip, the lip-muscles tightening more and more, until accompanied or followed by an intensive pressure of the mouthpiece upon the lips. Kinaesthetic perceptions of muscular contractions in the arms were rare; but fragments or faint traces of these were occasionally reported. An auditory image of the note to be produced usually preceded the intensive pressure of the mouthpiece upon the lips; this image was frequently of such indefinite quality that the peculiar horn clang-tint could not always be recognized; it sometimes resembled the tone of a bell. After the first few trials of exercise *a*, the auditory image was usually lacking; but in exercise *b*, the auditory image was present throughout, and was succeeded by the withdrawal of the tongue from the teeth.

Exercises *c* and *i* were characterized by a presence of kinaesthetic images of a twitching of the lip muscles, and a kinaesthetic perception of the contraction of the lip muscles antecedent to the producing of the tone d, this perception being of relatively long duration. These two experiences did not occur with the other tones. Vocal-motor innervations frequently entered consciousness at about the same time as 'pull, pull,' together with a kinaesthetic perception of a strain of the throat muscles which persisted until the tone had become clear; soon after the tone had cleared the strain disappeared.

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[5] This shadow serves as a warning to the player of the horn to inhibit the contraction of the muscles of the hand and arm.

In exercise *c* the slurred tones were produced without tongue articulation, with a constantly moving column of air. In the early trials it was found to be quite impossible to sustain the open d at all,—almost as soon as it was sounded it would suddenly change to e; and the same experience occurred in descending,—*i.e.*, the tone elided into c before the d had become clearly articulated. It seems apparent that the learner had not yet acquired a proper position of the lips for sustaining a tone between c and e.

Exercise *h* indicated that the duration of the contraction of the lip muscles had been increased. After practicing scales for half an hour, it was found to be more difficult to contract the lips to the position required to produce the open tone. There was less inclination to effect the d, a disinclination to continue the effort. A more intensive and sudden movement of the diaphragm was also noticed when attempting to produce the d. A contraction of the arms and an intensive pressure upon the lips were also reported.

In all of the exercises which involved tonguing, there was reported an auditory perception of hissing which increased in intensity but which ceased abruptly when the tone made its appearance. A cutaneous perception of the tongue touching the gums above the upper front teeth was occasionally reported, as also was a straining of the muscles of the throat. Practice before the mirror furnished a check and a confirmation of the introspections.

A subsequent series of exercises dealt with the formation of the lips for the producing of the open d as a clear tone, with an efficient articulation with the tongue, and with the producing of a clear tone without the tongue in the slurred passages, the muscular strain in the throat being avoided. In these exercises, brief passages of open tones in that portion of the scale most easily within reach were played slowly, with a view to attending to first one and then another of these various factors.

A brief series of exercises was undertaken where the mouthpiece was detached from the horn and used alone; here the procedure consisted in imitating the act of spitting, and in placing the tongue carefully between the front teeth. Some of this practicing was done before the mirror, in order to assist in discovering a position of the lips which would be favorable to the production of d and would avoid the straining of the throat muscles. Another part of this corrective practice consisted of exercises which involved the sustaining of notes where the intensity of the tone was increased without alteration of its pitch.

When the same exercises were repeated a year later, the introspections indicate that there had been a marked improvement in the lip adjustment and in the supporting factors. Straining of throat muscles is now rarely present, excepting with exercise *h*. Tonguing is more clear-cut and habitually from the edges of the teeth; in higher notes, at the teeth; in the lower notes, slightly between them. No hissing is now observed except under conditions similar to exercise *h*, and in attacking a low note immediately after a high note. There is no longer any intensive pressure upon the lips; and excepting in cases of the highest notes, no enlarging shadow between the tendons at the base of the left thumb (which serves as an index of the presence of an undesired contraction of the arm and hand). The lip muscles appear to move by quick short jerks, especially between c, d and e. Auditory images usually appear before the first note of a passage, especially with such exercises as *a* and *b*. Affective toning of agreeableness is frequently present, with a vocal-motor-auditory innervation of 'fine' and a kinaesthetic perception of stretching the body as if to rise upon the toes or to jump up and down. This occurred in a similar form in exercise *h*, when the passage was accomplished recently without apparent exertion.

ii. *Damping the tone.* A study of the player's technique in damping the tone first revealed the habit of pressing the tongue firmly against the teeth. In consequence of this procedure the tone was cut off abruptly; instead of tailing off gradually like the fading sound of a bell, the tone had a blunt and rough ending. This led the writer to undertake a detailed study of the process of damping; we arranged a series of twenty-one experiments which attacked the following problems: *a*, stopping the tone by means of the tongue; *b*, an attempt to produce in the horn-tone such a gradual tailing-off as is characteristic of the fading clang of a bell; *c*, the damping of sung tones; *d*, the damping of spoken syllables; *e*, the damping of staccato passages with the horn.

The experiments under *a* involved simple exercises of the open tones of the scale of c, and were of two forms. In one series, the tone was damped by pressing the tongue between the teeth; in the other series, the middle of the tongue nearly touched the roof of the mouth. This latter method of damping had been suggested by an observation of the act of pronouncing the syllable 'ku' in the triple tonguing of the cornet, the tonguing being similar to that which is present in the process of pronouncing 'tu, tu, ku.' Our experiments indicated, however, that no such means of damping could be utilized in horn playing; the method is tedious and difficult, and the effect is distinctly unmusical.

The *b* and the *c* series of experiments were of similar nature; but in the latter the tones were damped shortly after enunciation while in the former they were held until it was nearly time for the next note. Introspections at the outset here revealed some contraction of the throat muscles, a movement of the tongue upward and forward, and a sudden interruption in the diaphragm described as a 'hitch' in the region near the ensiform cartilage. The larynx was involved, the experience being described in the introspections as resembling swallowing. Introspections where the tone was struck immediately after damping, then damped and immediately struck again, report the presence of an extreme movement of the tongue 'from the back of the mouth' to 'touching the teeth;' it seems probable, however, that two movements occur here,—that of the base of the tongue and that of the free portion. The writer believes that the tongue is relaxed to the floor of the mouth where it lies almost flat, from which position it is extended so that the tip touches the teeth. Hence it seems to move a greater distance than it does.

It seemed probable that a study of the procedure ordinarily employed in the damping of sung tones and in the damping of spoken syllables would throw light upon the question as to what is the best procedure to follow in damping the tones of the horn. Accordingly we arranged two series of experiments; in a first series the player was asked to sing 'do,' to sustain it during two beats of the metronome, then to damp it, and describe his experience; to sing 'dee,' sustaining it for a time, finally damping it and describing his procedure; to sing 'too,' sustaining, damping, and reporting as before; to sing 'ha, ha, ha,' rapidly, attending especially to the conclusion of each syllable. In the experiments with spoken syllables, he was asked, successively, to pronounce the syllables 'I,' 'be,' 'bud,' 'bug,' 'too,' 'took,' and in each case to describe his experience especially with regard to the conclusion of the syllable.

The introspective descriptions obtained from these experiments show that one is distinctly aware of movements of the diaphragm and of the pharynx when one proceeds to damp sung tones and spoken syllables; and these introspections indicate that these diaphragmal and laryngeal movements probably give rise to the damping of the tone. In consequence of this finding we arranged a series of exercises where an attempt was made to throw the bulk of the damping upon the diaphragm, and to concentrate attention upon the factors involved These exercises, which were played upon the horn, were practiced regularly for a period of three months; and they were subsequently resumed after an interim of nine months. The notes contained in these exercises were separated by an interval of an octave or a sixth, this magnitude of interval necessitating considerable time for lip adjustment, and hence affording a favorable opportunity for observing the procedure employed in damping. Practice before a mirror showed that at the outset, the tongue, the larynx and the pharynx were actively concerned in the process of damping; but by appropriate variations of our exercises we succeeded within six weeks in reducing the movements of the tongue and the larynx to a minimum.

And when after an interval of nine months the exercises were resumed, with special observation of the damping of staccato and legato notes, it was found that considerable success had been achieved within that portion of the horn-scale which is most frequently employed. The transition from a high note to a lower note over an interval of an octave is now accomplished by a rapid and accurate lip adjustment and a clear-cut tongue movement in the articulation. The tone is sustained without difficulty, a contraction of the diaphragm being maintained with no strain of the throat muscles. It is now possible to damp staccato notes with a rapid but gradual diminution of intensity; the damping of legato notes is less perfect.[6] It seems that the slight change in the pressure of the air by a momentary interruption of the contraction of the diaphragm has not yet been attained. Tones in rapid passages appear at the present time to be quite continuous, without interruption in the diaphragm; in slow passages a distinct damping is perceived.

d. *Study of the tuning process.* i. *To acquire accuracy and facility in playing tones true to pitch.* It had been observed during orchestra rehearsals that the playing of certain passages was not always accurate with regard to pitch. This was especially noticeable in the case of e-natural, which was frequently played somewhat flat. A series of tests was undertaken to determine whether the fault was due to a defective pitch discrimination, to a lack of appreciation of intervals, or to a neglect of some of the elementary factors known to be essential in the production of single tones.

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[6] The writer's interpretation of a legato tone is one which is tongued very softly, and with a slight but barely audible diminution of intensity.

This series of four tests was made in October 1915; corrective exercises were then begun and continued until December 1915, when the tests were then undertaken. These tests have been repeated (January 1917,) in order to determine whether any improvement had resulted from the corrective exercises. The instructions of the tests were:

a. Strike e-natural (in the absence of any other source of pitch). *b.* Play the scale of c major in ascending order; tongue c, then c of the next octave higher; introspect especially from the time of the attack upon the lower single note after playing the scale. *c.* Strike c; slur to d; then to e. *d.* Tongue d, d-sharp, e, e-flat and d in slow succession.

The results of these tests indicated that the inaccurate playing was not due to a defective discrimination of pitch or of intervals, but to a defective adjustment of the player's lips, in consequence of which the note was flatted. The player succeeded in producing e accurately from memory, when instructed to do so. It seemed obvious that his flatted e could be sharped enough to make it a true e if only the pressure of the mouthpiece could be eliminated. A practice series was undertaken with this in mind for the twofold purpose of allowing an auditory image either of e or of d to function, and of allowing the player to attend to it and to bring his note into unison with it if possible.

After these exercises had been continued for a few weeks it was found that e could then be produced without great effort and with satisfactory precision. Intensive pressure upon the lips is now (February 1917,) entirely absent.

ii. *Tuning to another instrument.* This problem was investigated at about the same time as the foregoing. It had been observed that in case of a slight difference in pitch,—horn and piano, for instance,—the player was sometimes in doubt as to whether the notes of the horn were sharp or flat. In order to throw light upon this phenomenon the following exercises were devised:

a. Sound middle c on the horn; sustain it until after its equivalent on the piano has been sounded, and long enough to judge whether the clangs are alike or not. *b.* After the f on the piano has been struck and the clang has died away, tongue c on the horn. *c.* Tongue e (the usual tuning note with orchestras); let the clang die away;

the equivalent on the piano will then be struck; after it has died away, report on the whole experience.

These were subsequently supplemented by a series of daily exercises which were designed to afford practice in distinguishing slight differences of pitch, and in determining whether a given horn-note was sharper or flatter than a piano-note. The conditions of these exercises were analogous to those of *b* in the above list, which involved a concentration of attention upon the fundamental tone of the piano-note.

It was found that when the difference in pitch (horn and piano) was less than a quarter-tone it frequently failed to be detected; differences amounting to a quarter-tone were always detected, but the auditor was sometimes uncertain as to the direction of the difference,—*i.e.*, as to whether the horn was sharp or flat. The perception of the fundamental tone of any given piano-note or horn-note was frequently found to be vague and indefinite, under the conditions of these experiments.

The investigation of the tuning process was extended to include tympani and piano, the procedure here being similar to that followed in the case of the horn and piano.

Here again it was found to be impossible to distinguish slight differences of pitch when the two instruments were sounded simultaneously. It was discovered that tuning was facilitated when the octave of the drum-note was struck upon the piano; the first over-tone of the drum-note was readily perceptible with each tap of the drum-head. It seemed to make no difference whether the drum-note was struck before or after the piano-note; in either case the auditor was able to distinguish minute differences of pitch but he was not always able to reach an immediate judgment as to whether the drum was sharp or flat. An auditory image of the piano-note and a tentative humming of the note accompanied the subsequent adjusting of the drum-head screws. When this adjusting had been completed, the over-tone of the drum meanwhile being brought into unison with the imaged or hummed piano-note, it was found that there was little, if any, difference in pitch between the piano and the drum. These results indicate that the auditory or vocal-motor image may serve as an accurate means of tuning.

e. *Manipulating the valves of the horn: a study of motor coördination.* It had been observed in a number of runs that the pitch-difference between a and a-flat seemed to be greater than that between a-flat and g in the descending scale. A closer examination of this phenomenon, however, indicated that the pitch-differences were not objectively unequal but that an illusion of inequality of pitch-difference resulted from the fact that a longer time was required for depressing the a-flat combination of keys than for depressing the a combination. The a-flat combination is operated by the second and third fingers; the a combination, by the forefinger and the second finger. The reaction-times of the various fingers were measured by means of a Sanford vernier chronoscope, when the following averages were obtained (results are expressed in sigma or thousandths of a second): forefinger, 160 sigma; second finger, 210 sigma; third finger, 270 sigma; forefinger and second finger in combination, 210 sigma; second and third fingers in combination, 360 sigma.

These findings show that the coördination of the writer's second and third fingers is decidedly poor, notwithstanding his year of piano practice, and notwithstanding his frequent use of a typewriter and a comptometer. This defective coördination proved to be a handicap in the performing of horntrills which involved these fingers, especially in combination. A series of exercises with trills and a form of gruppetto (or turn) involving a and a-flat were practiced five minutes daily for several weeks. Three weeks after this practice was begun, the original tests were repeated. At this time it seemed wholly impossible to depress the second valve and then to alternate the first and third valves in time with the metronome (eighty beats per minute). After a few notes had been played, the third finger would lag behind, or the second finger would move with it; in consequence of this, split tones resulted, or the metronome struck before the tone had been produced. The difference in reaction-time was now of about the same magnitude as before,—forefinger, 140 sigma; second finger, 200 sigma; third finger, 260 sigma; forefinger and second finger together, 210 sigma; second and third fingers together, 370 sigma.

Practice was continued, somewhat irregularly, for an additional period of three months; and the tests were again repeated. It still proved to be impossible to hold the middle finger down consistently and alternate the movement of the other two. All went well for a brief period, but after that the middle finger began to accompany the movement of the third finger. The combination of first and second valves required practically the same amount of time as the second and third valves. Experiments with the metronome indicated no difference; the movements a, a-flat, g, g-sharp, a, etc., were in unison with the beats over a period of one minute. The chronoscope showed no essential change from the preceding test.

III. *Summary*

Of the difficulties selected to be studied, those which are reported are involved in producing, maintaining and damping a single tone, in playing single tones on the horn true to pitch, in tuning to another instrument, and in coördinating the fingers which operate the three valves. With the aid of introspective analysis, it has been found to be possible to diagnose difficulties in the production of the single tone, to correct a faulty habit of tongue placing, and to articulate the tone efficiently and accurately immediately after the tongue is withdrawn. With regard to the damping of the tone we have found it to be possible to make a partial analysis of the process, but not to analyze it completely. It appears to be practicable to damp the tone far away from the mouthpiece, at the diaphragm, interrupting the outward flow of air at the source of pressure. This enables the player to approximate the fading clang of a bell, although the fading of the horn-tone is less gradual. This device provides a damping which is of considerable value in musical passages involving especially staccato and legato notes. In the limited scope of the exercises described in this investigation, the art of producing legato notes has not been completely perfected. It was observed, however, that a diaphragmal damping was effective in spoken syllables and sung tones. In our study of playing the horn true to pitch, our introspections indicated that while auditory images play a part, they do not function extensively. In the case of one tone played below pitch, it was discovered that the difficulty was due to a too intensive pressure upon the lips, which prevented a sufficient contraction of the lips; this difficulty was overcome during the investigation.

Tuning of the horn to the piano was materially aided by attending to an auditory image if the piano were struck first; when the horn-tone was struck first this proved to be impossible. Slight differences in pitch could not be distinguished when the horn and the piano were sounded simultaneously; and this was also true in the case of the tympani and piano. In tuning the kettle-drum, the auditory image functioned but was accompanied by a humming of the piano-note. The hummed note was compared with the first over-tone of the drum-note as the drum-head was tapped in tuning; the pitch of the hum did not suffer materially in the tuning process. And finally, introspections and a chronoscope served to locate a difficulty in the muscular coördination of the valve fingers; and when the difficulty had been located, subsequent practice led to a decided improvement of the player's technique.

IV. *Conclusions*

These experiments show that introspective analysis, by a trained observer, may be of service in the study of instrumental music. They indicate that the mental processes involved in learning to play a musical instrument are complex and intricate; that the detection of errors of technique may be aided by attending to these mental processes, and that an improvement of the technique of instrumental music may thus result from an efficient employment of the method of introspective analysis.

Our investigation shows that an additional tool is available to the student of musical pedagogy. The student who has a sound knowledge of general psychology and who has been trained in the use of the methods of the psychological laboratory finds himself in possession of an equipment which gives him a distinct advantage in the study of musical technique.

FUNDAMENTAL THEOREMS IN JUDGING MEN.

By Edward L. Thorndike, Teachers College, Columbia University

The judgments of men with which we are concerned are judgments of the man's fitness for some defined purpose. Such are the judgments by a life insurance company of a man's fitness to be insured, or the judgments by an examining board of a boy's fitness for entrance to college, or the judgment by an employer of a man's fitness for a certain job, or the judgment by a recruiting officer of a man's fitness to be a soldier. The theorems to which I ask your attention concern the amount of weight to be attached to any given fact or combination of facts about a man in making such judgments. Our problem is the abstract one of the general theory of weighting facts about a man and of using them conjointly to influence the judgment of his fitness. The theory will be illustrated from time to time by particular examples, but you should not let either the merits or defects of these distract you from the abstract issue to which they refer.

Consider first the case of a job, fitness for which is assumed to depend upon five facts *a b c d* and *e* and only these five.

a being the amount of He which the man possesses,[1]
b being the amount of Ho “ “ “ “
c being the amount of In “ “ “ “
d being the amount of Co “ “ “ “
e being the amount of K “ “ “ “

Case I.

Using J to mean the amount of fitness of a man for the job, assume that any increase in He produces a proportional increase in J, as shown in Fig. 1.

Assume similarly that any increase in Ho, In, Co and K produces a proportional increase in J, each acting independently regardless of the amount of any other one of the five.

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[1] If it aids memory for these symbols, the reader may think of He as *health*, Ho as *honor*, In as *intellect*, Co as *ability to command men*, and K as technical special knowledge and skill, but the case is to be argued in entire abstraction from any facts not stated in the assumptions.

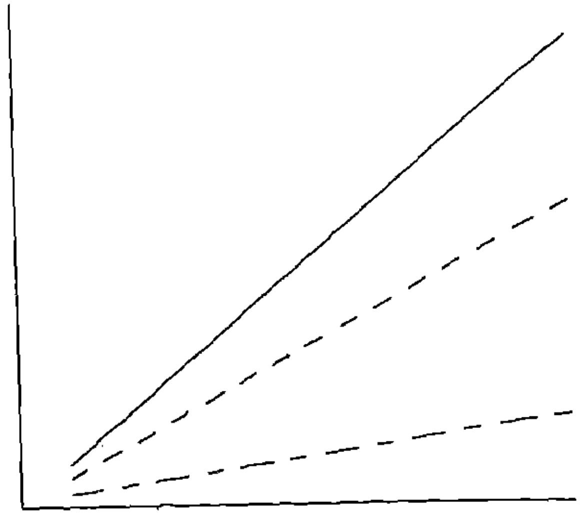

FIG. 1.—Specimens of rectilinear relations. Amounts of the symptoms are scaled from left to right. Amounts of J are scaled from the base-line up.

Then we can estimate by how much one man is superior to another in J if we know the amounts of He, Ho, In, Co and K that each has, and know the slopes of the relation lines for axes scaled in defined amounts of J and He, Ho, etc. We arrive at a man's status in J by adding the amounts of J he has by reason of whatever amounts of He, Ho, In, Co and K he has. If, in respect to production of increase in J, one unit of He = 1 unit of Ho = 1 unit of In = 1 unit of Co = 1 unit of K, it suffices for all practical purposes of selecting for J to add He, Ho, In, Co and K. If 1 Ho is of more importance than 1 He, that is, produces a larger increase in J (say 1.7 times as large), it suffices for all practical purposes to multiply the man's amount of Ho by 1.7 and then add. That is, when increments of the symptoms of J produce proportional increments in the thing to be selected for, we select by adding the amounts of the symptoms, these having been weighted by multiplying each by a constant which is expressive of the number of units of J produced per unit of He, Ho, etc., respectively.

This assumption of proportionality or rectilinearity in the relation line is behind most of the scientific work that has been done with educational and vocational selections. The technique of partial correlation coefficients and the regression equation, for example, assumes approximate rectilinearity of the relation lines.

CASE II.

Assume the same independence of influence as before, and assume that each increment of He, Ho, etc., increases J, but do not assume proportionality between the increments of He, Ho, etc., and the increments of J. We then have an infinite number of possible relation lines, a few of which are shown in Fig. 2.

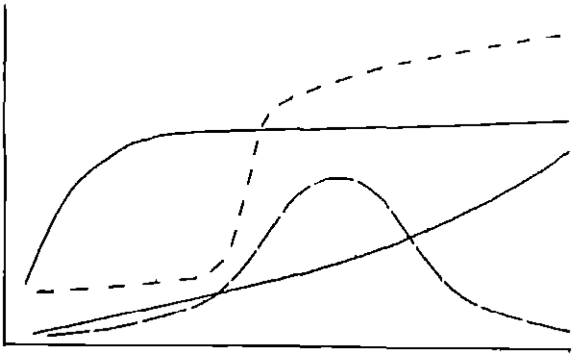

FIG. 2.—Specimens of non-rectilinear relations. Scaling as in Fig. 1.

Certain cases deserve special attention. For example observe Fig. 3a where the same increment of a symptom produces less and less effect on J according to the amount of the symptom already present. Such might be the case with health and strength in the case of fitness for a job as a law-clerk or

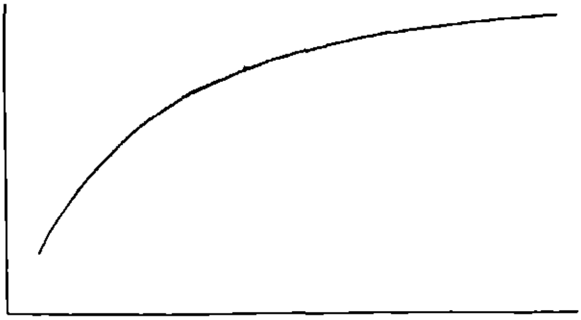

FIG. 3a.—A relation whereby successive increments of the symptom produce smaller and smaller increments of *J*. Scaling as in Fig. 1.

stenographer or teacher, for example. One step up from invalidism might mean much more gain in fitness than an equal step up from a robust and athletic level.

In Fig. 3b we have the converse case where a given increment does not amount to much unless it is an addition to already fairly large amounts. So, for example, the semi-interquartile range, or median deviation, of musical ability, when added to zero, would be of nearly zero value as a sign of fitness for employment as a soloist; but the same amount, when added to the ability of a second-rate performer worth $4 an evening, might make him worth $400 an evening.

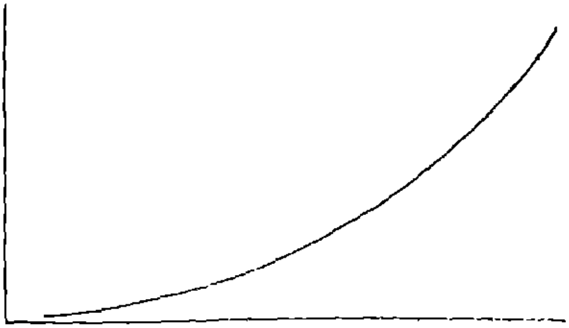

FIG. 3b.—A relation whereby successive increments of the symptom produce larger and larger increments of J. Scaling as in Fig. 1.

In Figs. 4 and 5 we have the case of a quality which suddenly rises in value as a symptom from nearly zero to nearly its maximum.

It is very hard to find cases of intellectual or moral or economic qualities in men which are related to any important variety of fitness after the fashion of Fig. 4 or 5. Indeed it is hard to find important physical qualities which are. Yet the existence of such a relation is the only justification for an enormous number of widespread practices in selecting men as fit for suffrage, for life insurance, for entrance to college, and for the army and navy. Wherever a certain line is drawn as to weight per inch of height, temperance with alcohol, liability to heart disease, length of education, or the like, all those below the line being given equal credit (usually in the form of 'failed,' 'rejected,' 'unsatisfactory' or the like) and all those above the line being given equal credit (as 'normal' or 'passed' or the like), this single perpendicular-step relation is pragmatically assumed.

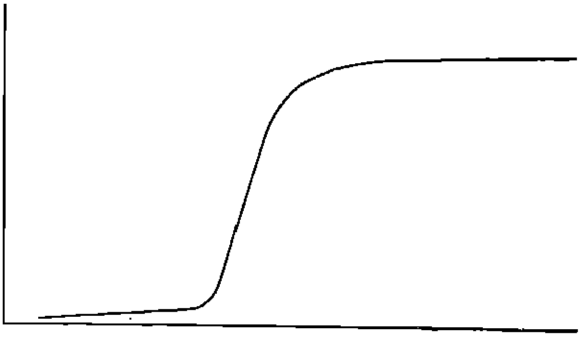

FIG. 4.—A relation whereby successive increments of the symptom produce almost zero effect save at one short interval of the scale. Scaling as in Fig. 1.

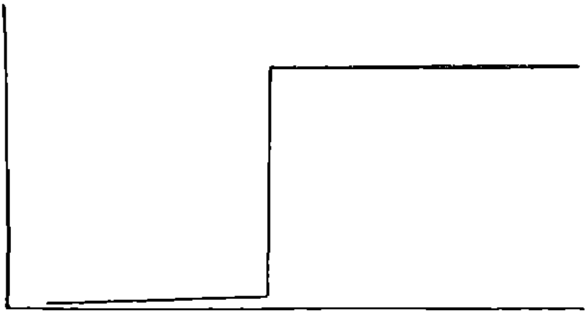

FIG. 5.—An extreme case of Fig. 4.

It may be wise, for certain legalistic reasons and for convenience in making and recording decisions, to cut the whole range of variation of a quality into two sections, crediting all amounts in one section as 0 and all amounts in the other section alike. It should be understood, however, that the procedure is almost the worst possible so far as concerns selecting the best quota of men. Only a failure to use the symptom at all or a negative use of it could be worse. For a line of zero slope, perpendicular slope, and then zero slope is an extremely poor fit for any of the relation lines in question. It is least objectional in cases of infection, as with malaria or syphilis.

How inefficient it is may be realized pictorially by Table I where the total credit really due two certain men is contrasted with what they receive by the "perpendicular" or "all or none" treatment. A similar inefficiency, though not so great a one, *must always* occur, the error being statistically that of excessively coarse grouping.

TABLE I—SIXTY BEING REQUIRED TO PASS, PASSING BEING REQUIRED IN NINE OUT OF TEN TRAITS

	Individual A	Individual B
Trait I	62	92
" II	64	88
" III	65	85
" IV	63	90
" V	49	49
" VI	65	52
" VII	66	86
" VIII	61	94
" IX	70	83
" X	62	87
Av.	63 passed.	81 failed.

It is beyond the scope of this paper to balance this loss in efficiency in selecting the right man against the inconveniences of measuring each symptom along a linear scale, weighting it according to its relation line and combining weights by addition. The inconveniences are often great, but I am decidedly of the impression that the inconveniences resulting from failing to get the best possible selection of men are as a rule many times as great.

The failure to use a scientific procedure is not so much due to apprehension of its real difficulties as to ignorance of its merits and the assumption of demerits which do not exist. Custom and language mislead us into treating a continuous distribution of variations as if they fell into sharply distinct groups, legal requirements in particular often exacting such clefts. The insecurity of fine grouping, and the lack of knowledge of precisely the best weights to attach, are assumed to be demerits which coarse grouping and zero or constant weights avoid. They do not avoid them.

Of whatever sort the relation line may be, the procedure is still (so long as the symptoms exert their influence independently) to attach weights and add. The difference from the first case of proportionality is that each separate increment of each symptom now may need its separate multiplier.

CASE III.

Consider now the case where certain traits seem superficially each to produce an effect upon fitness for a job, but where really their value lies largely in a common element. Thus suppose that being born from the professional classes correlated to an extent of +.5 with success as an army officer, that length of education so correlated, that standing in class so correlated, that score in examinations at the training camp so correlated. Suppose that we have a thousand men ranked in these respects and also in ability to command men, which we will suppose also correlates +.5 with success as an army officer. The first tendency of a superficial thinker is to assign equal weight to each of the five traits. But if, as is likely, the first four intercorrelate closely, being related by a common element, say intellectual capacity, whereas power to command men correlates much less with their sum, the last should be given much more weight than any of the first four. To prevent all such errors we use either an experimental analysis or the technique of partial correlation.

The fundamental theorem in question may be stated as: Do not weight the same contributing element twice because it appears in two or more traits. Or, more adequately; Attach weights to elements according to the amount of their contributions, irrespective of the number of symptoms in which they appear. A full determination of independent elements and their contributions, whether experimental or by the method of partial correlation coefficients, is very difficult, and has never been made in any case, to my knowledge. A complete determination is indeed not necessary for fairly efficient prophecy. Where the best possible weighting would prophesy fitness with say, a resemblance to demonstrated fitness of .95, a prophecy to the extent of .90 will commonly be reached by such a rough weighting as a competent thinker can devise in an hour or two upon inspection of the relevant correlations. So for practical purposes, we may translate the theorem into: Attach weights to traits only after knowledge of their intercorrelations.

CASE IV.

Consider now the case where a symptom's amount of influence depends upon not only the amount of the symptom itself, but also the amount of some other symptoms. For example, suppose that each increment of intellect (In) contributed 3 J, that is, 3 units to fitness for a certain job, if only a certain low degree of honor (call it 5 Ho) characterized the man, but that the same increment of intellect (In) contributed much more J if the man was twice as honorable (10 Ho). Or, more precisely, let the relation of intellect (In) to fitness (J) be line *a*, when honor (Ho) is 0, line *b* when honor (Ho) is

1, line *c* when honor (Ho) is 2, line *d* when honor (Ho) is 3 or more as shown in Fig. 6. In such a case the amount of In is obviously to be multiplied by a factor proportional to the amount of Ho in addition to all other weighting of In.

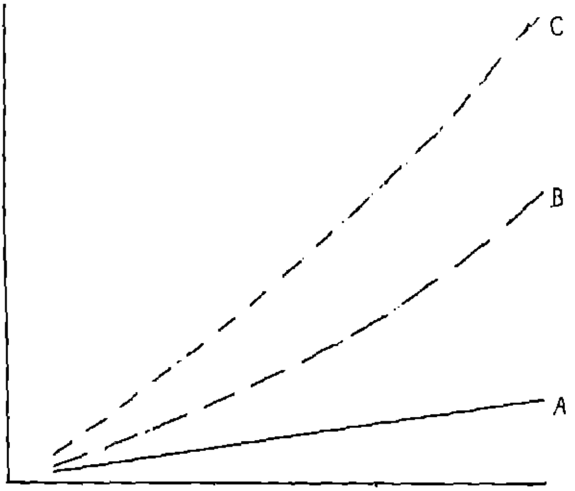

Fig. 6.—A relation whereby the amount of J produced by some factor depends also on the amount of some other factor. A, B and C are three different relations between a factor and J, depending on the amount of a second factor.

The dependence of the amount of influence of a trait upon the amount of some other trait possessed by the man will often be more complex than that described in the illustration. For example, the value of technical knowledge and skill for a certain job might vary as the square root of the man's intellect or as the square of his intellect. There may also be many sorts of irregular relations in these dependencies of one trait's influence upon the amount of another trait that is possessed.

I am not aware that any scientific investigation has measured any of these dependencies. There is, however, good reason to believe that they exist and are important. A man's possession of what we call energy, for example, seems to be a multiplier for his intellect or skill. A man's loyalty or devotion in any particular job seems to be a multiplier of his other equipment for it. What we call roughly interest in success, or determination to succeed, or ambition, seems to be a multiplier for energy. And in theory, at least, we must admit it as a fundamental theorem that prophecy of the degree of influence *of any amount of trait requires consideration of the amount* of every other trait in the man in question.

There are other principles concerning the use of facts in the selection of men which must be followed to make the best possible prophecy, but limitations of time prevent their discussion now. In the time that remains I may simply summarize our findings roughly and compare the scientific with the impressionistic or intuitional use of facts about a man.

We have seen that the status of a man in the traits relevant to fitness for a job may be expressed in an equation:—John Doe $= 7a + 9b + 4c + 21d$. . . . A prophecy of his fitness relative to other men is obtained by attaching weights to a, b, c, d, etc., in view of (1) their relations to fitness, (2) their partial constitution by common elements, and (3) any dependencies whereby one gains or loses in influence according to the amounts of the others which are present. The setting up of an equation of prophecy from an equation of status will usually be very complex, but a rough approximation, if sound in principle, will often give excellent results. In so far as the lines of relation, interrelation, and dependency are rectilinear, the technique is greatly simplified; and a rough approximation to this is probably often the case.

Even when approximations are used and when, by good fortune, many of the relations concerned are rectilinear, sound procedure will still be more elaborate and difficult probably than has ever yet obtained in practice. Practice is thus justified to some extent in judging fitness experimentally by tests with dummy operations like those of the job in question, as well as analytically by a weighted combination of contributing elements.

All this study of relation lines, intercorrelations, facilitations and inhibitions and resulting weights by multiplying and adding, represents a scientific execution of just what the competent impressionistic or intuitional judge of men tries to do. The strength of such intuitional judgments in comparison with the formal systems of credits and penalties of the past has been, not that the intuition was less quantitative, but that it was more so! The formal systems of the past have used symptoms merely additively and often with only an "all or none" credit. They have not allowed for the undue duplication of credits by intercorrelations, and have not sensed the importance of the multiplying effect of certain traits upon others. The competent impressionistic judge of men does respond to these interrelations of the facts and sums up in his estimate a consideration ot each in the light of the others.

If there are ten traits involved, say ten entries on an application blank, he may be said to determine his prophecy by at least 10 + 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 quantities, since he responds to each trait in relation to all the others. There is a prevalent myth that the expert judge of men succeeds by some mystery of divination. Of course, this is nonsense. He succeeds because he makes smaller errors in the facts or in the way he weights them. Sufficient insight and investigation should enable us to secure all the advantages of the impressionistic judgment (except its speed and convenience) without any of its defects.

A PLAN FOR THE TECHNICAL TRAINING OF CONSULTING PSYCHOLOGISTS

By L. R. GEISSLER

The rapid progress which applied psychology has made in recent years, and especially the services which it is rendering in the present national crisis, are turning the eyes of its supporters towards the future in an effort to determine, on the one hand, the best means of making the results obtained by scientific investigations available to the various fields of human endeavor and, on the other hand, to protect the unsuspecting public against the exploitations of pseudo-psychologists. The latter have quickly recognized the great possibilities of applied psychology, especially in the fields of business, vocational aid, and mental hygiene, and though possessing little or no psychological training, they have acquired sufficient psychological vocabulary to supplement their oratorical or literary gifts. Some have even gone so far as to gather a large number of empirical observations upon which to base semi-scientific systems of mental aids for business, character or occupational prognosis, and similar purposes, and in some instances are known to have made, intentionally or unintentionally, exaggerated claims of accomplishment. It is evident that such people hurt the cause of applied psychology more than they help it. In order to draw a sharper line of distinction between them and the academically trained applied psychologists the latter will sooner or later be driven to adopt some professional badge or means of exclusion similar to those existing among other academic professions and highly trained specialists. This seems the more desirable as the term psychology has always been misunderstood and misapplied by writers and laymen alike, and a continuance of such misuse will work the greater harm, the more widely the term psychology is being employed.

Concerning the other question of determining the best means for making the results of applied psychology most readily available to the concrete problems of everyday life we may refer our readers to Hollingworth and Poffenberger's recent book on *Applied Psychology* which in the last chapter discusses the future of applied psychology. Here the authors point out that "in the application of any science to the concrete purposes of practical life some adjustment of existing machinery or the development of some appropriate institution or professional avenue must always be made." Then they show that "in the case of chemistry the method has been established of placing the scientifically equipped worker in the midst of the industrial plant, providing him with adequate means of research and definitely setting for him the nature of the problem with which his research has to deal . . . . In the case of physics there has developed an entirely new professional group, the engineers . . . . In the case of psychology neither of these two methods of adjustment has as yet been widely adopted, although tendencies in both directions may be observed." After discussing three other types of adjustment of a more or less unsatisfactory and temporary nature, the authors come to the conclusion "that the solution of the immediate future in applied psychology will be similar to that commonly adopted in the case of applied chemists, bacteriologists, etc. It is to be expected, however, that in time the rapid development now going on in applied psychology will make necessary the engineering type of psychotechnic expert, the consulting psychologist."

There seems to be no question that this new profession of consulting psychologists has passed its incipient stage, and has fair prospects of permanently establishing itself amongst us. Its initial successes are undoubtedly due to the fact that it is counting among its earliest and most active members some of the foremost psychologists of the country. If we are right, then, in predicting an increased demand for technically trained consulting psychologists, it becomes our duty to provide a supply which shall be adequate both in quality and in number. In the writer's opinion this problem may be solved in a way which at the same time offers a solution of the other problem of eliminating the self-styled psychologists mentioned above. The plan proposed here consists, briefly, in standardizing the term "consulting psychologist" and permitting nobody to use it except those who have had a certain amount of technical training certified to by a collegiate degree. But before requesting higher institutions of learning to confer the title of "consulting psychologist" upon certain of their graduates, analogous to the present custom of giving teachers' diplomas and similar distinctions, it seems necessary for psychologists to agree upon a more or less uniform plan for the future collegiate training of such men and women as are to be admitted to this new profession.

With a view of more quickly accomplishing this aim, the writer has submitted below a tentative plan for the uniform training of consulting psychologists, in the hope that it will arouse a widespread discussion and ultimately lead to some definite results. The present plan involves both a qualitative and a quantitative differentiation. The latter consists in providing three titles, parallel to the bachelor's, the master's and the doctor's degree, namely, "assistant consulting psychologist" (A. C. P.), "consulting psychologist" (C. P.), and "expert consulting psychologist" (E. C. P.). The qualitative differentiation consists in a special training in certain branches of applied psychology,—medical, educational, industrial or the like. In the following discussion the writer has placed greater emphasis upon the undergraduate training, because here the question of uniformity seems the more important and more pressing. This is especially true of the first three college years, before any pronounced qualitative specialisation is to be undertaken. The proposed plan is based upon the customary collegiate units of fifteen credit hours per week per year, or the completion of sixty credit hours for graduation.

In the first year a student should be required to take a three-hour course in English, where composition in technical language, the making of briefs and outlines, and the summarizing or reviewing of technical literature should form a considerable part of the content of the course. Another three-hour subject is mathematics which in many cases may not need much modification from the traditional contents of such courses. A third course should be in general sociology, in which the student is to be introduced to the manifold problems of human society, with special emphasis upon such topics as demand and supply of labor, crime and institutions of correction, systems of civic and other forms of government, social and charity work, methods of caring for defectives, and the like. If the freshman has had no modern languages before entering college, he should now take a three-hours beginners' course in French and also in German. If, however, he has had at least two years of either or both in high school, he should now take an advanced course in that same language.

The sophomore year is to continue the elementary foreign language work with advanced courses. Where, however, such an advanced course was taken in the freshman year, it may now be followed by a general introductory course of three hours in such subjects as commerce, education, law, hygiene, genetics, or others. In addition, elementary courses in physics and biology of at least three hours each and preferably including some laboratory work are to be required. (The customary substitution of at least two hours of laboratory for one recitation hour of credit is here accepted.) Finally, the sophomore year is to include an introductory or elementary course in general psychology of three hours, which is to be of the nature of a general survey of the whole field of psychology and its various branches, but without reference to any particular system of psychology, although some emphasis should be laid upon the study of the normal adult human mind. This course need not involve any laboratory work, although experimental demonstrations before the whole class are desirable.

In the junior year I would require an introductory course in general psychology of three hours throughout the year, in which the student is to become acquainted not only with the most important ancient and modern systems of thought, but also with the general content of such other philosophical disciplines as logic, ethics, aesthetics, metaphysics, etc., in order to give him a better understanding of the various mental sciences and their intimate relations to psychology and to prevent him from falling into the errors of psychologism and false hypostatisations. There is to be offered a full year's course in theoretical psychology of a more advanced nature, familiarizing the student with various systems and theories and introducing him to the original sources. This course should be paralleled by a laboratory course of at least six hours a week (three credit hours) in which the student is to become familiar with the experimental work in sensation, perception, reaction, attention, association, introspective analysis, Weber's law, the quantitative methods, and related topics. A two-hour course should be equally divided between the translating of French and German psychological texts, in correlation with the theoretical course. A one-hour course (to supplement the two-hour language course) is to be offered in statistical and other advanced mathematical methods, partly to correlate with the experimental work and partly to be preparatory for the senior year work in mental measurements. The remaining three hours may be left either as general electives or else taken up by such general introductory courses as were permitted to take the place of French or German in the sophomore year. It is assumed that the work of the first three years of college as outlined above can be offered by any standard college in this country with a moderate equipment for a psychological laboratory.

In the senior year the first qualitative specialization is to begin; as the student is now required to make a definite choice among the various fields to which psychology is at present being applied. He is to take a general survey course of three hours in applied psychology which is to offer an outline of the whole field of applied psychology, its scope, aims, methods and results. This is paralleled by a laboratory course in mental measurements and tests, of six hours weekly, and is to give him an opportunity to learn to conduct the tests on other individuals. The remaining nine hours are to be divided among a major subject of two courses and a minor subject of one course of three hours each. The major and minor are to be selected from the following groups of topics: A, Commerce, including journalism, marketing, manufacture, management, advertising, and the like; B, Law, including pleading, evidence, general criminology, penology, sociology, and others; C, Education, including teaching, administration, supervising, educational measurements, vocational guidance and selection; and D, Mental Hygiene, including psychiatry, neurology, psycho-analysis, psychotherapy, and similar topics. It is expected that a student will select for his major and minor groups such courses as stand in close relation with each other. These courses are to be of a more advanced nature than similar ones taken in previous years, and are understood to be offered by specialists in these lines, except perhaps in some courses included in the last group, which might be offered by members of the psychological department.

It is evident that the variety of courses included in the four groups is not likely to be found in the curriculums of many of the smaller colleges; and it is even questionable whether any institution should make an effort to offer all these courses. For, if a student has decided upon a certain combination of subjects for his major and minor, he need only transfer his college work to that particular university which offers him the best opportunities of studying these subjects. The uniform preparation during the first three years of college work should greatly facilitate such transfers; and the possibility of limiting the work of specialization to a few universities which have greater facilities for teaching the professional subjects should enable these larger institutions to concentrate greater efforts upon this line of work and to enlarge their possibilities for conducting such courses more effectively.

Students who have successfully completed four years of the kind of academic training sketched above and have thus earned the title of "assistant consulting psychologist" should be eligible for minor positions in the four fields of applied psychology. For example, a person who specialized in the first group might act as administrator of mental tests in employment offices or as psychological adviser in advertising departments, or he might become an assistant to an expert consulting psychologist in some commercial concern. A man with special preparation in law would be able to conduct tests or gather statistical material in institutions of correction or in connection with juvenile courts, or similar institutions. Those who had specialized in education would be prepared for minor administrative positions in small school systems and act at the same time as vocational guides. Similarly, those who majored in the last group will be able to fill minor positions in institutions for mental defectives, or to supplement the work of medical examiners in private practice or in public offices. It would seem advisable that those who plan to prepare themselves for the higher titles would first acquire several years of practical experience in such minor positions before taking up post-graduate courses.

Concerning the latter but few recommendations need be made here. In preparation for the title of "consulting psychologist" and the master's degree it would seem advisable to continue the specialization along the line of either the major or minor subject selected in the senior year, with further advanced work in theoretical and experimental psychology and a thesis on an original minor problem. This kind of preparation should make the successful candidate eligible for such independent positions in his particular line as involve greater originality, independence, and responsibility.

Finally, the title of "expert consulting psychologist" together with the degree of Ph. D., are to be conferred upon the successful completion of at least two years of additional graduate work in all the different branches of applied psychology, with further specialization along two particular lines, preferably those engaged in before. Original research of a major problem and the publication of the doctor's thesis are in line with the customary requirements of obtaining this academic honor. The successful candidate is eligible to the highest positions offered in the various fields of applied psychology, especially to those which involve original research and independence of action as well as those which consist mainly in college teaching of the most advanced courses in applied psychology.

It is needless to point out that a few of our higher institutions of learning are already giving this kind of advanced training in applied psychology. Their practical experience in this professional preparation of consulting psychologists should be of great value in the demarcation and standardization of a uniform plan of training; and we hope to induce especially the present directors of this kind of technical training to contribute to this discussion such criticisms and suggestions as will be most helpful to the cause of applied psychology.

In conclusion we may briefly restate the main points of the proposed tentative plan for the technical professional training of consulting psychologists: it suggests in the first place a uniform undergraduate course of three years obtainable in most of the smaller colleges at present, to be followed in the senior year by a more specialized professional course at some larger university: in the second place, it proposes the conferring by the institutions a graduated series of titles, such as assistant consulting psychologist, consulting psychologist, and expert consulting psychologist, parallel with the three regular collegiate degrees; and lastly, it recommends a qualitative subdivision of the various fields of applied psychology for the sake of more intensive specialization and preparation, along such lines as commerce, law, education, mental hygiene, and others. It may be deemed advisable for the American Psychological Association to consider this question officially and to refer it either to a special committee or to one already concerned with similar topics.[1] The *Journal of Applied Psychology* will be ready to publish further communications or contributions to this subject; or, if desired, to conduct a symposium on the question at issue.

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[1] Since this was written the author has learned that the appointment of a special committee was authorized by the American Psychological Association at its recent annual meeting in Pittsburgh.

PSYCHOPATHIC LABORATORY AT POLICE HEADQUARTERS, NEW YORK CITY

By Dr. E. I. KELLER, Consulting Psychologist

In December, 1916, the Psychopathic Laboratory at Police Department in New York City was opened for the examination of certain prisoners. The whole laboratory force consisted of psychiatrists, neurologists, psychologists and social workers, in order that they might bring to bear on the same subject different points of view, thus demonstrating that science—psychology, medicine and sociology—can make valuable contributions in solving one of the social problems of the metropolis, problems heretofore entrusted only to the police and the courts. This group was not only to serve the city in the examination of prisoners, but to engage also in research work along the lines of psychology, sociology and medicine.

The plan was, first, to make an intensive mental and physical survey of arrests in a certain district of the metropolis; the one chosen being the First District, south of Fourteenth street, between Bowery and East River; and, secondly, to begin a study of recividists. There are certain prisoners brought daily to Police Headquarters, that the Rookies, the new police, may see them at the morning line-up and thus become familiar with the various types of arrests throughout the city.

By March 1917, the staff in the Psychopathic Laboratory consisted of 3 psychiatrists, 1 psychologist, 1 social worker, loaned by Dr. Davenport of Cold Spring Harbor, 1 Secretary with his assistant-stenographer and typist. For the past four or five months a medical man has been daily at the Laboratory at Police Headquarters, ready to answer any call that might come in from this First District from 7 A. M. to midnight. The whole staff, save one on night duty, are in the Laboratory during the day.

The line-up at Headquarters is held daily about 8:45 A. M. Two or three medical men sometimes visit prisoners in cells, watch them when finger prints are taken or before they appear on the line-up. They always note their conduct on the line-up and decide which ones showing certain abnormal tendencies need further mental and physical examination. These are sent to the Psychopathic Laboratory about 9 A. M. They are then examined by neurologists, psychiatrists and psychologists who are all in attendance from 9 o'clock on.

This hour is most advantageous for examination, as the prisoners are examined before they go up for trial, by persons who are interested in each one as an individual, not primarily in their crimes; except as the result of their study finds its place in the developmental history given later. The disadvantage is the lack of time, for all prisoners must be examined in time to get them to court by noon or earlier, and many courts are situated in distant parts of the city.

The laboratory for the psychological examination is well equipped with all the necessary apparatus to test many types of adults. The Binet tests are of little service save in those rare cases which are mentally much below par—that is, in the range of imbecility or idiocy. The mass of the cases are above the age of puberty, when differentiation sets in, and they call for a wide knowledge of all standardized tests and a wide experience with all sorts and kinds of adolescents and adults to enable the psychologist to make a hasty examination of any real value. Two, and often three, psychological examinations were given while the psychiatrist and neurologist had one or two hours to get the detailed history of one or possibly two patients. In addition to the test returns, and to make the psychological examination possible of interpretation, a certain amount of personal history had to be taken so as to cross-cut as often as possible the mental life of the subject in order to tell where the probable weak points were that called for further examination. Emotional reactions especially had to be watched, and the attitude and manner of the prisoner both to the examiner and to his work while under examination, had to be noted. Time also was required to get the prisoner into a normal state of mind that he might do his best. Always some written work was obtained to verify the school history, which of course was given only by the prisoner and was in nearly all cases very unreliable. It was necessary for the psychologist to have at immediate control the essential subjects of the common grades that a prisoner declared he had reached. He would declare, for example, that he had passed the 8th grade but be unable to read or cipher like a first year pupil. This might be indicative of poor memory or of the deteriorating effect of some nervous disease, like epilepsy, or, if both of these were eliminated, it probably denoted a tendency to prevarication. The written returns from tests proved later, at staff meetings, more valuable for diagnosis than any mere account of his school history or life given by the prisoner himself.

After the physical and mental examinations were over, and prisoners were sent to court for trial, the staff meeting was called and cases examined were brought up for consideration. Each prisoner's personal, family and school history were read, the account of the crime as the arresting officer gave it as well as the account of his own arrest given by the prisoner himself and the returns of psychological examinations, as interpreted by the psychologist, were reviewed. Each one present was asked to comment on the case and a provisional diagnosis was made.

Often, however, it was necessary to send letters to the judge when the prisoner left even before staff meeting could be called. The director obtained a hasty report from psychiatrist or psychologist and formulated a letter on cases when prisoner was so obviously insane or so feeble-minded that the court would accept the diagnosis and a hospital or a school would be suggested as the haven of the prisoner instead of a penal institution.

A study of the 502 cases coming to the Psychopathic Laboratory from the day it opened in December 1916 to May 1, 1917, was made by the director, who offers the following classification based on determined diagnosis:

46 Insanity
82 Mental Defects
  Mental Defects 35
  Subnormal 4
  Moron 36
  Imbecile 7
3 Epilepsy
5 Psychoneurosis
8 Sex Perversions
66 Drug Habituations
38 Alcoholism
2 Abnormal Character
20 Emotional Instability
43 Psychopathic Characters
28 Asocial Characters
77 Unclassified
84 Not obviously abnormal

Of the 46 insane all were recommended to Bellevue Hospital for observation, in the hope that further commitment would be to the State Hospital for the Insane. Of the 82 with decided mental defects only the lowest group (7) were recommended for institutional care, this leaves 75 of low mentality not recommended for commitment. The hurried examinations often forbade any regular, complete physical examination on the part of the physician. To a psychologist it was very interesting to note how significant the mental side of the problem was as against the physical. Even when there were marked stigmata of degeneration, the mental side of the picture in its lack or deterioration was more significant than any physical condition, and the medical men, as well as the psychologist stressed this in diagnosis. The interpretation of the personal and family history and the test returns of psychological examinations called for mental insight, and one was led to feel that all one's training and experience in psychology as well as in psychiatry were called constantly into service, to get at the underlying causes of the prisoner's difficulties. Glance over the classification made by the medical director, and leaving out the obviously insane and mentally defective, consider such terms as abnormal character, emotional instability, psychopathic character asocial character, in order to realize what a large part psychology takes in these divisions of the problem. Then consider how complex each individual is and how, even bringing long experience and training in mental problems to bear, we but scraped the surface of the life of those who fell under the head of psychoneurosis and sex perversion, drug-habituation, alcoholism, etc. These are mere symptoms, not syndromes. Some of us, versed and interested in psycho-analysis, felt that, as Dr. W. A. White suggested, these drug and alcohol cases have sought "a flight from reality" in alcohol and drug and would prove fine material to support or refute the theory of psycho-analysis, could they have been held for further examination. We desired a place at Bellevue Hospital for all these doubtful cases that they might be held under observation for further examination before even a diagnosis could be given, or any plan for re-education suggested.

When one realizes the chronological age of these so-called adult prisoners he sees the great need of getting at the causes that lie back of their delinquency. Of the first 200 cases sent to the laboratory, all male, the mode was 17 years and the average age or median was 21 years—150 falling between 16 and 24 years. In 502 cases of arrest, note that only 84 cases are not obviously abnormal. To the hard-headed taxpayer of moderate intelligence it must be clear that to have laws and conditions such that adolescent boys become recidivists and are educated into crime, at an awful cost to the community, is absurd and wasteful, nay a crime of the law that allows it. To study the cases mentally and physically so as to educate aright, or to re-educate and then send many of them back to find their places in the community, will cost less than our present extravagant method of making them recidivists or repeaters in crime.

From the material gathered at police headquarters research can be done by medical, psychological and social workers. It is up to the individuals gathering this valuable data to interpret it for an intelligent public, to show the need for further work along these and related lines. This research work is individual and qualitative and calls for a genetic point of view—not group or quantitative and mechanical. Hope lies here for fine work for clinical and consulting psychologists, co-operating with psychiatrists and medical men.

With a biological and genetic point of view, scientists can thus discover where the youths have tripped or failed to develop and so suggest a possible cure, or better, some real preventive measures.

A NOTE ON MENTAL PECULIARITIES AS SYMPTOMS IN STUTTERING

By WALTER B. SWIFT (Boston) and JENNIE HEDRICK
(Washington, D. C.)

Can the subject under consideration be better expressed than by the query: In what way does the mental make-up of a stutterer differ from that of a non-stutterer? Are there mental symptoms which accompany the stutter? If so, what are they?

The object then will be to state a norm and compare the stutterer with it. We shall therefore begin with a definition of the norm, then give a description of several stutterers, and finally enumerate the points which conform to the norm and which do not.

In a normal brain all the brain areas are in a healthy condition so that they can function correctly. The intake through the sensory areas is duly interpreted, collaborated and sifted before passing through the motorium into speech. The result is shown in a well modulated, flexible speech over which the intellect rules.

With this norm before us, let us carefully scrutinize some of the stuttering cases treated for a month.

They can be separated into two distinct classes. One class has a *high-strung shrinking nature. Their speech is hasty* and uninhibited. Their thoughts are confused and dominated by the fear of stuttering. Their ever active minds demand expression. They resort to speed in utterance in order to sidetrack the stutter if possible. Though they fall, they are quickly up again. They may be called the optimists. They show an early quick onset of fatigue of their mental processes. The fear of stuttering is their worst enemy. They make the effort to speak, and then comes the unwelcome fear, with the accompanying break in the mental activities.

The members of the other class are phlegmatic. Apparently they have no thoughts waiting to be expressed. No fear of stuttering appears in their faces. They have learned to hide behind a closed countenance. They are the pessimists. They expect failure, so make no attempt to speak. This expectation dominates all their relations. They play games which call for no speech. They read considerably. They refuse to answer in school, though they know their lessons. They are not interested in their fellow beings, are unsociable, taciturn and lonely.

The following are in the first class:

Case 1.—12 years old. Comes into the room and glances hastily around to see how she is to be received. Holds herself tense. Her thoughts are expressed in as few words as possible and in a quick, hasty manner. She is self-conscious, timid and repressed, she assents to all questions and is relieved when told "that is all."

Case 2.—10 years old. Rushes into the room with head foremost and breath exhausted; is eager to tell his thoughts, but is immediately tripped by the stutter. His mind, as well as his body, is active. He tries to perform his exercises before his mind has grasped the instructions. He shows an active mind uninhibited and easily fatigued.

Case 3.—Age 24. Although quick in thought and actions, he is confident that no one can cure his stutter. It is his most precious possession and he is loath to part with it. His mind is clear and active. He says that he seldom speaks in the words in which he thinks. Three or more words rush into his mind at the same time. The result is "confusion worse confounded," as his face testifies. In vain he tries to utter the chosen word and finally, when a word is pronounced, the idea which he has tried to express has vanished. One can easily understand how this inability to express his thoughts has caused him to select an occupation which requires no talking. To his credit be it said that he hopefully looks forward to a professional career.

The phlegmatic type is depicted in the following cases:

Case 4.—Age 10. A good mentality which is repressed. He avoids plays which call for speech, does not recite in school nor talk much at home. He has learned to keep silent pretty much all of the time.

Case 5.—Age 10. Enters the room with an indifferent expression. He is non-observant, unsociable and taciturn. Speech is not spontaneous but has to be coaxed. Apparently he considers his trouble incurable and submits meekly. Shows no marked effort to be rid of it.

Case 6.—Age 20. His trouble is ever with him. His answers are monosyllables or short sentences. He expects little and is not ambitious. Another hopeless stutterer.

Case 7.—Age 14. Has a quiet manner. Is dazed when asked to think. When told to do one of two things finds it difficult to make a choice. Answers "yes" or "no" to all questions. Would rather be scolded than attempt an explanation. Says very little and even that has to be drawn from him.

Case 8.—Reticent. Answers in short sentences, sensitive and sometimes dull.

Case 9.—Age 25. Has a slow, measured gait. Thinks slowly and speaks slowly. All his movements are carefully watched so that there may be no undue speed. His answers are short.

Case 10.—Age 5. Shy and silent. Takes her trouble seriously and allows it to overshadow her mentality.

In brief, the peculiarities found in these ten cases are:

Brevity—short answers and short sentences
Sensitiveness
Self-consciousness
Self-repression
Undue speed in speech
Uninhibited speech
Confusion of thoughts
Early and quick onset of fatigue in mental processes
Unsociability
Taciturnity
Despondency
Reticence

Summary of Findings.—We must conclude that stuttering forces the patient to do or perform numerous peculiar things which are wanting in normal people. These can properly be classed as symptoms of stuttering; they are surely performances that find their origin in the malady. Then, too, they disappear from the life as soon as the trouble vanishes.

BOOK REVIEWS

ROBERT S. CARROLL. *The Mastery of Nervousness Based Upon Self Reeducation.* The Macmillan Company, New York, 1917, p. 346.

Modern civilized life with its complexity and intensity is held responsible for the many cases of nervous debility which are now common to all classes of people. According to the author present conditions are more and more frequently presenting the individual with the question "Shall I lower my standards, shall I surrender in whole or in part; or shall I select wisely and train for mastery?" He believes that the latter decision is possible for the majority of serious-minded men and women and makes the purpose of the book to show how this end may be accomplished. The ground is taken that the possession of a nervous temperament under proper control means high capacity for work and enjoyment, whereas, if disordered or uncontrolled, it means keen capacity for suffering. Nervousness as viewed by the author is not due to any physical condition of the nerves but "represents a high capacity for response to external and internal stimuli with lack of selective and inhibitory control."

The main part of the book deals with the different types of nervousness including the motor, hypersensitive, suggestible, hypochondriac, neurasthenic, self-centered and repressed nervous; with their causes, among which are discussed the effects of heredity, faulty diet and dietary habits, insufficient exercise and play, defective thinking based on ignorance and false notions, weak wills, uncontrolled emotions and wrong moral attitude; and finally with the methods for correcting the physical, mental and moral disorders which are responsible for the condition of nervous debility.

The treatment of the hereditary causes of nervousness is made to include a much broader field than that which would be accepted by the modern geneticist in that the author includes such deranged conditions as are transmitted from parent to offspring through body poisons and disease germs as well as through the germ plasm. This point of view, however, does not affect the practical value of the book. From a biological standpoint the rest of the work is accurate and thorough. It is written in simple, untechnical language and in a most interesting style so that it will appeal to the layman for whom the book is especially designed. The advice given is based on sound hygienic principles and should be helpful in bringing many sufferers of nervousness back to health.

I. A. FIELD.

H. L. HOLLINGWORTH AND A. T. POFFENBERGER. *Applied Psychology.* D. Appleton and Company, New York, 1917, p. 337.

This work is intended to serve, on the one hand, "as a general text of applied psychology, presenting its principal aims, types, methods, its various fields of endeavor, and its outstanding results and accomplishments," and on the other hand, to fill "the need for an exposition of the subject which should be comprehensive, suggestive, and interesting without sacrifice of definiteness, accuracy and balance." In this attempt the authors have been eminently successful, and they have rendered a great and lasting service to the student, the teacher, the general reader, as well as to applied psychology itself.

In the first half of the book the subject is treated from the standpoint of "the personality and competence of the individual, regardless of his or her particular occupational activity." The first chapter deals with the definition, scope, history, difficulties, and limitations of applied psychology. It owes its rapid recent progress, according to the authors, to the fact that psychologists have become more interested in the outward signs of mental life, the behavior of the individual, and that "consciousness has become an aid to the understanding of behavior, instead of the reverse." Behavior itself is said to depend upon the integrity of the physiological mechanism, heredity, education, and the present stimulus or appeal to action. These four factors are made the basic topics of the subsequent eight chapters. The second and third chapters deal with the influence of heredity upon achievement and with family inheritance. The fourth chapter discusses under the heading of efficiency and learning the nature of the learning process, the relation of efficiency to habit formation, to acquisition of skill and to memory, and the effects of practice on individual differences. To the reviewer this chapter seems to be logically out of place and should follow naturally after the discussion of the environmental conditions. In the fifth chapter the influence of sex and age on efficiency are discussed. Here several distorting errors occur, the charts on pages 93 and 95 are interchanged, and on page 96 the table showing the averages obtained at the age of eighteen with eight mental traits is not sufficiently well explained and seems also to contain one or two typographical errors. The next two chapters consider the influence upon efficiency of such factors as ventilation, especially temperature and humidity, climate and season of the year, weather, daily rhythm, illumination, distractions, monotony, and solitude. The problems of work, fatigue, rest, sleep, and optimum duration of work periods are well summarised in the eighth chapter, and the ninth chapter in a similarly poignant way enumerates the physical and mental effects of tobacco, alcohol, coffee, tea, strychnine, and other drugs.

In the second half of the text "the attitude, content and technique of psychology are considered in their particular relevance to the various types and fields of occupational activity." The tenth chapter tries to justify this threefold division of utilising psychology. The characteristic psychological attitude is said to be one of analysis of mental complexes, which is being applied to the analysis of human behavior. The application of psychological knowledge consists in the direct use of scientific facts of mental life in the attempts to make human behavior more efficient, while the application of psychological technique consists in the employment of psychological apparatus of precision, test-material, methods of procedure, control of conditions, use of control subjects, elimination of sources of error, and the mathematical and statistical methods of gathering and computing data and results. Of the three divisions the first seems to the reviewer the most superficial and questionable, and the whole *principium divisionis* seems rather artificial and of little intrinsic value to the subsequent discussion. If this principle is of such importance for the second half of the book, why is it not equally applicable to the topics of the first half? The seven occupational activities treated in chapters eleven to seventeen are executive management, industrial work, commerce, law, social uplift work, medicine, and education.

From the point of view of the executive or employer the services of applied psychology are needed in the vocational selection of employees, in the problems of individualisation and management, in the analysis, simplification, and standardisation of work and tools, in devising programs, records, schedules, means of reward, recognition and merit, and in the provision of sanitary conditions for work, opportunities for recreation, and pleasant home-environments. The point of view of the worker (chapter twelve) considers his mental set, the effective distribution of his efforts and organisation of his movements, the possibilities of time and motion studies, and the psychological effects of such methods on the worker. The psychology of business is only briefly outlined with reference to the consumer, the advertiser, and the salesman. A much more suggestive treatment is given to four aspects of legal psychology, those concerning the acumulation of evidence, the evaluation of testimony, the determination of responsibility, and the adaptation of corrective measures. In dealing with the psychology for the social worker, the mental causes of misery, the existence, diagnosis, and consequences of mental deficiency and abnormality, and the significance of the frequency distribution of mental traits are emphasised. In discussing the relations of psychology to medicine the following statement is made: "It may be said at once that in so far as medicine has profited from its utilization of psychology, this profit has been mainly by way of methodology and technique. In so far as there has been any interchange of content, psychology has been far more blessed in its receiving than in its giving. Medical clinics and medical practices have been drawn on freely for data, problems, suggestions and illustrations, and psychology still shows, in many quarters, pronounced anatomical, physiological and clinical bearings" (p. 286). Whether one is willing to agree with this statement or not, he will find it difficult to either prove or disprove it, and as it stands it is not apt to improve the inter-relations between the two disciplines. The applications of psychology to education are likewise discussed under the three-fold division, and it is pointed out that in all three instances education has derived great benefits from psychology, both in theory and practice. A short concluding chapter deals with the future of applied psychology and the means of making its results more readily available to the problems of practical life.

While the authors in the first chapter emphasise that the field of applied psychology is "to be every situation in which human behavior is involved and where economy of human energy is of practical importance," they forthwith omit to mention the many other topics which such a broad statement might include, and are thus apt to give the general reader a wrong idea of the complete scope of applied psychology. From the teacher's point of view the value of the book would be still further increased by the addition of bibliographical references at the end of each chapter. Considering the fact that the present volume is rather of a pioneer character, being the first comprehensive text on applied psychology, the authors have aimed at and attained a high standard of excellence, both in the presentation of their subject-matter and in the scientific conservatism and sound judgment displayed in their critical estimates of recent experimental studies. No student of applied psychology should fail to read this valuable text.

L. R. G.

HENRY F. ADAMS. *Advertising and its Mental Laws.* The Macmillan Company, New York, 1916, p. 333.

Advertising as it is typically exemplified in the popular weekly and monthly periodicals of large circulation is here considered from "the behavioristic standpoint." Other kinds of advertising are given only scanty attention, chiefly in the introductory chapters. The preface states that "this book is intended for students of the psychology of advertising though much of the material which is contained in it will undoubtedly be of benefit to the man who is in the practical side of advertising." Three chief aims are stated: First, "to present in simple language the basic facts and principles of psychology which are related to advertising and to point out the application of the principles." Secondly, "to reduce the complexity of a printed advertisement to its elements and to show with mathematical exactness the effect of the various elements." Thirdly, to point out the close agreement betwen the results of laboratory experiments and "the results of advertising campaigns in which similar problems have been involved."

The book begins with an introductory section of about 70 pages devoted to a general consideration of the nature and problems of advertising under the chapter headings; I. Definitions and Functions of Advertising; II. Advertising and Psychology; III. Advertising as a part of the Environment; IV. The Different Kinds of Mediums; V. Informing the Customer; VI. Experiments in Advertising. Following this is a short chapter, VII. Statistical Methods, in which the ordinary terms and procedure employed in the interpretation of statistical material are explained. The next seven chapters, constituting the bulk of the book, give an exposition of the psychology of attention, memory, etc., with a discussion of related problems in advertising. The laboratory methods which have been devised in connection with the psychological study of advertising are here fully explained and illustrated. Much original work by the author is included here, along with many results which have been published before. The chapter headings in this section are; VIII. Attention; IX. Holding the attention; X. Association; XI. Fusions; XII. Memory; XIII. The Appearance of Advertisements; XIV. Action; XV. Sex Differences, A short final chapter, XVI. Results obtained in Advertising closes the book.

As a whole, the main purposes of the book as set forth in the preface have been achieved. In regard to the mathematical exactness with which the effects of different factors in isolation have been determined, in "an endeavor to put the Psychology of Advertising on a quantitative basis, a strictly scientific basis," there is undoubtedly room for disagreement as to whether in many cases, *what is measured* can be stated with equal exactitude. It is also doubtful whether the form frequently used in stating results, illustrated on p. 114—"The attention value of frequency of repetition varies approximately as the 1.12 root of the number of presentations"—conveys to the average reader any exact idea of the quantitative relation involved.

There is much constructive criticism of laboratory investigations relating to advertising, and possibly the reader will find the greatest contribution of the book to the literature of the subject in the sections where the experimental procedure and results are discussed.

The method of approach to the problems of advertising which is employed here will probably appeal more strongly to the undergraduate student than to the practical advertiser. In certain chapters there is a complexity of structure which is baffling to the reader who attempts to keep track of the relations of the various subdivisions. For example, there is on p. 87 a division designated by I, followed by a subdivision 1; three pages later we find another set of sub-divisions 1, 2 and 3, followed by a section A in which there are again sub-sections 1, 2 and 3: sections B, C, D and E follow, with sub-sections; then on p. 106 appear sub-divisions 2 and 3 followed by 4, 5, 6 and 7, and on p. 116 we find what may be division II, and on p. 120 what may be division III, though the numerals are lacking. Other chapters, notably XII and XVI show a similar complexity, with a misprint on p. 327, where the section should obviously be numbered 2, instead of 1. The graphical presentation of experimental results, which is freely used to good advantage throughout the book would in many instances be of greater value if the quantities whose magnitudes are plotted were clearly indicated, and the unit of measure specified.

There are in the book, numerous statements, which obviously would have to be modified if they were critically examined. As a rule however, they are not such as to affect the main conclusions. We may note: p. 156. "By contiguity and succession are meant recall owing to simultaneous or successive entrance into consciousness of two ideas," as typical example.

C. E. Melville.

J. Addington Bruce. *Handicaps of Childhood.* Dodd, Mead and Company, New York, 1917; p. 310.

This book is written "to demonstrate the importance of early training in the moral sphere." It has the following nine chapters: mental backwardness, the only child, the child who sulks, jealousy, selfishness, bashfulness and indecision, stammering, fairy tales that handicap, and night terrors.

The author warns that "many children have been erroneously pronounced feeble-minded when their backwardness is in reality due to remediable causes." Of the *only child* he says some things of practical interest, but the evidence he cites to indicate tremendous handicaps of the only child may not convince all his readers. Sulkiness is often traceable to indigestion, malnutrition, adenoids, bad teeth, eye strain; but it is due "in nine cases out of ten to home environment." Likewise home training is responsible for exaggerated jealousy in children The "bashful man is the victim of subconscious memories of distressing incidents of his early life; incidents which in his case have had the effect of arousing in an exaggerated degree sentiments of shame or fear." Indecision in adults likewise have their setting in early childhood. "Stammering * * * is not at bottom an anatomical or physiological trouble * * * it is a mental malady, symptomatic of a psychoneurosis having its origin in subconscious emotional states." It is curable by such mental means as suggestion and "specific recall and eradication of the 'forgotten memories' that underlie it." The parents' place is to "guard the young from needless emotional stress of early training, to foster in children, calmness, courage, self-confidence." Fairy tales are responsible for most of the fears and night terrors of childhood, and for like phenomena in adults. Dream analysis is called in as evidence.

With the general advice which Mr. Bruce gives to parents, most readers doubtless will agree. With his contention, however, tha home training is the chief cause of the several handicaps some will disagree. Numerous statements, such as the following, will hardly meet with universal approval: "in most cases the child who is a true dullard may be brought almost if not fully, to normal intellectual activity provided he is taken in hand at an early day" (p. 8); "Today scientists largely hold that not more than one or two per cent. of criminals can be stigmatised as criminals by birth; that insanity is not inheritable like eye color or hair color; and that nervousness is, at bottom, an acquired, rather than inherited, disorder" (p. 156); "the three principal causes of mental disease are excessive indulgence in alcohol, sexual indiscretions, and emotional distress" (p. 157).

In the hands of the uncritical lay readers, to many of whom Mr. Bruce is doubtless better known than are most eminent American scientists, such assertions are of doubtful value.

Brooklyn Training School for Teachers. GARRY C. MYERS.

IRVING R. ALLEN. *Personal Efficiency, Applied Salesmanship, and Sales Administration.* LaSalle Extension University, Chicago, 1917, p. 315.

In the first part the author discusses four problems of salesmanship. He begins by making the distinction between the direct purchase of some concrete article and the indirect offer of personal service. The successful salesman must apply both methods, that is, he must be able to sell his own services to the prospective employer, and the goods he deals in to the prospective customer. The next step is to impress favorably with the high quality of one's physical and mental equipment. The former includes personal appearance and health, the latter may be summarised by the terms personality and effort. Personality includes all unintentional influences due to self-confidence, fearlessness, ambition, will-power, concentration of attention, and sincerity. Intentional effort relates to cultivating a good memory for names and faces, effective speech, suggestion, tact, interest, initiative, and reliability. This section of the book contains many valuable hints to the student of applied psychology. The third problem deals with locating and securing the right position and winning promotion, that is, with the methods of buying and selling personality or service, while the fourth problem is concerned with the analysis and stages of selling goods.

The second part discusses sales administration under the following divisions: the product and its distribution, sound selling policies, the successful sales manager, bases of compensation for salesmen, controlling men in the field, the sales manager's records, hiring the new salesman training salesmen, and high-speed helps. Throughout the text each problem is well illustrated from practical business experiences, and there are many useful hints and suggestions as to how to meet similar situations. At the end of each main division there are a number of well stated and selected questions which are intended to help the reader apply the lesson of the text to his own particular circumstances and to analyse and observe the concrete situations with which he may be confronted. In this respect the present volume is perhaps one of the most useful texts among the many books of its kind that have recently appeared.

GREENVILLE KLEISER. *Fifteen Thousand Useful Phrases.* Funk and Wagnalls Company, New York, 1917, p. 453.

In his Introduction to this collection of pertinent expressions, striking similes, useful, significant and impressive phrases, literary, commercial, conversational and oratorical terms and synonyms, Frank H. Vizetelly gives a short account of the present day tendency among English speaking and writing people to overwork certain words and phrases, and he points out the need of reviving phrase-books which two centuries ago were considered valuable supplements to dictionaries and other language guides. Such an attempt at revival has been made by the author of this collection, which is intended as an aid in building up a large vocabulary and in developing clearness, accuracy, and diversity in oral and written expression. He submits a concrete plan of study of the contents for the busy man. The book contains eleven divisions; useful phrases, significant phrases, felicitous phrases, impressive phrases, prepositional phrases, business phrases, literary expressions, striking similes, conversational phrases, public speaking phrases, and miscellaneous phrases. In each division the phrases are arranged in alphabetical order.

There are no indications either as to the sources from which this material is taken, or as to the contexts in which it should or should not be used. Aside from the questionable merit of many phrases, it seems that a fruitful perusal of the book would pre-suppose rather than help to develop a delicate sense for good style and a keen appreciation of appropriate words and phrases.

HARRINGTON EMERSON. *The Twelve Principles of Efficiency.* (Fifth Edition). Industrial Management Library, The Engineering Magazine Company, New York, 1917, pp. xviii, 423.

In his short introduction to this work Charles Buxton Going poignantly says that it "reduces the doctrine of efficiency to a code upon which to base rules of practice." Five of the twelve principles concern the relations between employer and employee, the others deal with methods or institutions and systems occurring in manufacturing concerns. The workings of each principle are explained by the help of many positive and negative illustrations well chosen from actual practices and malpractices. It is impossible to more than indicate each principle briefly: 1. clearly defined ideals promulgated throughout the plant, 2. "supernal common sense" and sound judgment, 3. competent counsel wherever found, 4. the spirit of discipline and reverence for law and order, 5. the fair deal, based upon the exclusion of the many unfit and the selection of the fit, 6. reliable immediate, and accurate records, 7. planning ahead and despatching according to schedule, 8. standards and schedules, 9. standardised conditions of adjustment, 10. standardised operations, 11. written standard-practice instruction, and 12. efficiency reward.

The one critical suggestion that forces itself upon the reader of the many anecdotal illustrations is that there were fewer of them and that instead some space were devoted to practical hints or explanations as to the general application of the twelve principles to the concrete problems of modern industrial life. This is perhaps asking too much, and the next best thing is what the author of this volume has attempted to do, to reduce the complicated mechanism of industrial management to a few guiding principles and to illuminate their operation from as many angles as possible.

The following books and pamphlets have been received:[1]

Maximilian P. E. Groszmann. *The Exceptional Child.* Charles Scribner's Sons, 1917, pp. 764.

Horace Secrist. *An Introduction to Statistical Methods.* The MacMillan Company, New York, 1917, pp. 482.

Walter S. Athearn. *Religious Education and American Democracy.* The Pilgrim Press, Boston, 1917, pp. 394.

William A. White. *The Principles of Mental Hygiene.* The MacMillan Company, New York, 1917, pp. XV + 323.

Osias L. Schwarz. *General Types of Superior Men.* (With a Preface by Jack London and an Introductory Letter by Max Nordau). Richard G. Badger, Boston, 1916, pp. 435.

Frank B. and Lillian M. Gilbreth. *Measurement of the Human Factor in Industry.* Presented at the National Conference of the Western Efficiency Society, May 22-25, 1917. 14 p.

Carl C. Brigham. *Two Studies in Mental Tests.* 1. Variable Factors in the Binet Tests. 2. The Diagnostic Value of Some Mental Tests. *Psychol. Monographs*, Vol. 24, No. 1, 1917. 254 p.

Truman Lee Kelley. *Mental Aspects of Delinquency.* University of Texas Bulletin, March, 1917. 125 p.

Thomas H. Haines. *The Increasing Cost of Crime in Ohio.* Bull. No. 4 of the Bureau of Juvenile Research, June, 1916. 10 p.

Rudolf Pintner. *A Mental Survey of the School Population of a Village.* Reprinted from *School and Society*, Vol. 5, No. 125, May 19, 1917.

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[1] Mention here does not preclude further comment.

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HUGO MÜNSTERBERG

The following communication has been received:

Sir:—

The American Journal of Applied Psychology, June, 1917, p. 186-7 contains a translation of a letter to Professor William Stern of Breslau from Professor Hugo Münsterberg, which is published in the Feitschrift für Pedagogische Psychologie und experimental Pedagogik Jan.-Feb., 1917. The letter contains the following:—"Day and night I work before and behind the scenes in the interest of the political struggle, and fortunately thus I can accomplish much. Of course almost all of my old relations are severed, especially here in Boston. Most of my friends here no longer recognize me; I have been thrown out of clubs and out of Academies. All their rage has concentrated upon me but we hold out. . . . It is our plan to take the first Hamburg steamer, etc."

Professor Müusterberg belonged to only two American Academies—The American Academy of Arts and Sciences, Boston, and the Washington Academy, Washington, D. C.

I was president of the American Academy of Arts and Sciences when Professor Münsterberg, of his own volition, offered his resignation. It was accepted in dignified silence. The corresponding Secretary of the Washington Academy, Mr. Robert B. Sooman, writes that "Professor Münsterberg voluntarily presented his resignation to that Academy."

John Trowbridge.

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THE PERCEPTION OF SLIGHT CHANGES OF EQUILIBRIUM, WITH ESPECIAL REFERENCE TO PROBLEMS OF AVIATION[1]

By HAROLD E. BURTT

I. *Introduction*

Previous experiments upon the perception of changes of equilibrium have been performed on the tilting-board.[2] The subject, usually prone upon the board, was tilted to various positions and required to report the angle of tilt or to indicate the vertical. It is obvious that this type of estimation is quite dissimilar to that made by an aviator during flight. In an airplane one occupies a sitting posture and responds to relatively slight deviations from the perpendicular, and it is a case not of deliberate judgment but of choice reaction, correcting the motion of the plane the instant the direction of the tilt is perceived. Accordingly some experiments were performed bearing more directly upon the practical situation. Two problems were studied:

1. What is the relative delicacy of perception of slight changes of equilibrium in the various directions right, left, front and back? Differences in such perception, if general, would have a practical bearing on the selection or arrangement of airplane controls so as to facilitate reactions to the more difficult perception.

2. What are the merits of dep as compared with stick airplane control in reacting to slight changes of equilibrium? If the use of one hand on the stick or two hands on the dep

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[1] From the Harvard Psychological Laboratory.

[2] This work is summarized in Nagel's *Handbuch der Physiologie des Menschen*, 1905, vol. 3, p. 736 ff.

and the different movements involved constitute a variable sufficient to influence the reaction time, this fact might warrant the general adoption of one or the other type of control.[3]

II. *Method*

A heavy wooden platform 1 meter square was mounted so as to rock about a point 35 cm. below its centre. Iron braces from its corners met at a rounded plate below the centre and this rested on a flat plate on the base of the apparatus. A loose bolt held it in place. Heavy spiral springs under a little tension were attached from each corner of the platform to the base directly below. The platform was thus held normally in a horizontal position, but a moderate force applied to a corner would tip it in the desired direction.

The platform was tilted in some of the experiments by means of a crank and worm gear mounted on an upright about 50 cm. back of the platform. A sprocket on the shaft with the worm carried a short chain from the ends of which wire ropes led to two opposite corners of the platform through pulleys directly below the sprocket and other pulleys below the corners. The ropes were made taut by means of turnbuckles. Turning the crank lowered a corner of the platform and turning it in the opposite direction righted the platform or lowered the opposite corner. The wire ropes could be replaced at will by a set connected similarly with the other two corners. The arrangement was such that one turn of the crank lowered the desired corner about 6.35 mm., and the speed and distance could thus be controlled.

This arrangement, however, permitted the tilting of the platform at only relatively slow speeds, and therefore in some of the experiments a different system was employed. A heavy spiral spring, (heavier than those at the corners of the platform) was hung on one end of the chain on the above mentioned sprocket. From the lower end of this spring another chain passed under a second sprocket mounted on the base to the wire rope leading to a corner of the platform. Fastened rigidly to this second sprocket was a ratchet held by a pawl. Thus the heavy spring could be placed under any desired tension between the upper sprocket and the ratchet without disturbing the platform. When the ratchet was released the lower sprocket acted as a pulley while the upper one was stationary and the corner of the platform was quickly lowered, the rate and distance depending on the amount of tension placed on the heavy spring. An identical arrangement was connected to the other end of the upper chain so that two opposite corners of the platform could be operated reciprocally by turning the crank in the desired direction and thus operating the desired spring and ratchet. A single lever threw both pawls simultaneously and whichever spring was under tension would operate. Trials in two opposite directions could thus be given rapidly. To change to the other two directions required only a few minutes to connect the other ropes to the chains and adjust the turnbuckles. The springs gave the platform a negatively accelerated tilt such as an airplane makes when struck by a puff of wind or the like.

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[3] Two untechnical accounts of these experiments by the author have appeared in *Aviation and Aeronautical Engineering*, vol. 2, 1917, pp. 218 ff. and pp. 562 ff.

A chair was mounted on the platform facing one corner in such a way that the vertical axis through the center of gravity of the subject sitting in a normal position passed through the center of the platform. Thus a lowering of the corners tipped the subject directly forward, backward, right or left. In the work on the first problem the chair was an ordinary one which placed the subject's ears approximately 160 cm. above the point about which the mechanism rocked. In the second problem a lower chair was used and the subject's feet rested on a bar only a little lower than the seat of the chair (the position usually occupied by an aviator). In this case the subject's ears were about 130 cm. above the rocking plate.

Visual factors were eliminated throughout the entire experiment, the subject always having the eyes closed during a trial. The subjects with one exception were graduate students in the Harvard Psychological Laboratory. The remaining one had had considerable psychological experience. Two of the subjects were women.

III. *Perception of Lateral vs. Longitudinal Changes of Equilibrium*

In studying the delicacy of perception of a tilt in various directions both forms of apparatus mentioned above were employed. With the first arrangement the experimenter turned the crank at a constant rate (1 revolution in 2 or 4 seconds) timing himself by a pilot lamp flashed once a second by the laboratory time circuit. This speed lowered the desired corner of the platform at a constant rate of 3.175 mm. or 1.587 mm. per second.[4] This movement was practiced for several hours prior to the actual experiments and could be made quite even and continuous. The movement always started from the horizontal position,—the platform being righted between trials. The subject held in his lap a light piece of wood carrying two telegraph keys so mounted that the first and second fingers of the right hand operated the left and right keys respectively, while the thumb and other fingers grasped the edges of the base.

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[4] A drop of 3.175 mm. at the corner corresponded to an angle of 20 minutes from the vertical with the rocking plate as a centre.

The subject was instructed to close his eyes at the signal "ready" keeping his head upright and as soon as he was certain of the direction in which he was being tipped to press the corresponding key. The movement began about one second after the signal. The lateral and longitudinal series were performed separately, so the subject had always a choice between two alternatives, right-left or forward-backward. The right key was for the right tilt in one series and for the forward tilt in the other.

An electric contact was made by the crank when the platform started from the normal position and another when the subject pressed his key. The time was recorded by an electric counter in series with a 10vd. tuning fork or by a 50th second stop watch operated magnetically. Thus the longer the time the greater the distance or angle of tilt and the poorer the discrimination of movement. A double throw switch put a telephone receiver in series with the wrong key so that mistakes were heard by the experimenter.

In one hour four short series were given, e.g., lateral, longitudinal, longitudinal, lateral, and the average of one and four compared with that of two and three, thus avoiding undue influence of practice and warming up. During the next hour with that subject this procedure was usually reversed, i.e., in the above example starting with longitudinal. In a given series the two alternatives were presented in a chance order determined by shuffling a pack of cards. There were 10 to 15 reactions in a series, that is 40 to 60 during an hour.

Table I summarizes the results. Each row represents one hour's work. The first column gives the subject. The second column shows which of the four short series was given first, e.g., "Longitudinal" means that the order on that day was longitudinal, lateral, lateral, longitudinal. The third column indicates the percent by which lateral discrimination is superior to longitudinal, i.e., the percent difference between the average of the two lateral series and the average of the two longitudinal in terms of either time or distance. The last column gives this difference divided by the probable error of the difference. In the results presented in the upper half of the table the

TABLE I

DETECTION OF LATERAL VS. LONGITUDINAL MOVEMENTS AT SLOW RATES

Subject	Order	% superiority lateral	Difference
			P. E. difference
An.	Longitudinal	— 8	1.2
An.	Lateral	65	6.6
Ap.	Longitudinal	15	2.2
Ap.	Lateral	— 4	0.4
B.	Longitudinal	49	5.7
B.	Lateral	32	6.0
C.	Longitudinal	33	2.4
C.	Lateral	4	2.5
O.	Longitudinal	41	11.2
Sp.	Longitudinal	37	2.7
Sp.	Lateral	—13	1.7
An.	Longitudinal	25	2.6
An.	Lateral	30	2.9
Ap.	Lateral	31	3.5
B.	Lateral	14	2.7
C.	Longitudinal	42	3.4
C.	Lateral	7	0.8
O.	Longitudinal	27	5.5
O.	Lateral	6	1.9
Sp.	Longitudinal	33	4.1
Sp.	Lateral	13	1.6
Average		24.6	3.4

corner of the platform was lowered at the rate of 1.587 mm. per second and in the remainder at the rate of 3.175 mm. per second.

The general tendency of the results is obvious. Eighteen of the 21 series show a superiority in the detection of lateral movement, with an average superiority (including the negative values) of 25 percent. The differences are on the average 3.4 the probable error of difference. The mean variations (not given in the table) are slightly larger on the longitudinal than on the lateral, averaging 30 percent and 26 percent respectively. There are also more errors on the longitudinal than on the lateral,—17 percent of the total trials vs. 10 percent. The reactions to the lateral movements are obviously superior in all respects.

At the end of each hour's work the subjects were asked for introspection regarding the means by which they discriminated the movements, the comparative ease of the various judgments and anything else they may have observed. Specific questions were avoided in order to obviate undue suggestion or the introduction of a different set or attitude toward the experiment.

The criteria involved in the perception of movement of this sort appeared to vary considerably with the different subjects. *An* relied mainly on the static senses. "I perceive the movement in the head; but sometimes I feel it all through the body." *Ap* on the other hand appeared more dependent on his tactual sensations. "Get sensations from back, seat or feet." The pressure of the chair against his shoulder was mentioned most frequently. However he noted having the head in a position in which he could feel them,—"a delicate adjustment which it was hard to get." He sometimes noted a "pure bodily movement which was not localized." *B* noted several factors. "Usually feel it up and down back and in the head. Feels like a pulling around the waist. Sometimes feel feet slipping or feel self slipping on the chair." The tactual criteria seemed more marked in the lateral and the "head" criteria in the longitudinal movement. *C* on the longitudinal felt the platform under the feet or the seat. On the lateral he felt "as if a stick right down through the body tipped." Later he localized the motion outside himself. "I feel stationary and the plane tips under me." *O* judged mainly by "tactual sensations from the chair and kinaesthetic sensations in the neck." Static senses did not seem involved. *Sp* noted for the lateral movement, "Feels like a dumbbell through the head and I wait and see which way ear goes. I feel it in the ear." The longitudinal movement was harder to describe although it seemed in the head also. When she relaxed, however, she felt it in the body, especially in the legs. Thus the perception of a change of equilibrium such as the above seems in general to involve both tactual and static senses. One subject seemed to utilize the former solely but the other subjects employed both.

A further point of interest is the comparison of the subject's estimate of his efficiency in the various directions with his actual efficiency. *An* was "more confident of the sideways judgments; the others lacked clearness." This corresponded to his objective results. *Ap* noticed no difference in his ability to make the various estimates. *B*'s introspection was equivocal, some days considering the lateral the easier and some days the longitudinal, with no correlation with objective efficiency. *C* felt consistently more efficient on the lateral as was actually the case. *O* sometimes noted one direction easier and sometimes the other and there was no correspondence with objective results. *Sp* consistently reported the longitudinal as much more difficult and often unpleasant. However she tried to concentrate more on it and this sometimes reversed her objective results. Thus subjective estimates of ability to detect lateral vs. longitudinal movements do not correlate uniformly with actual ability.

In the results thus far described two rates were used, the interest being in the direction rather than the rate of movement. A few series were performed to test directly the effect of the latter variable. Trials at the two rates of 3.175 and .793 mm. per second lowering of the corner of the platform were intermixed in irregular order. The time of reaction and the distance tilted were averaged for the two speeds. On a given hour the trials were all lateral or all longitudinal.

Table II indicates the results briefly. Each row represents one hour's experiments. The first column gives the subject; the second the direction of movement; the third the percent superiority of the slow movement with respect to distance, i.e., the percent by which the average distance in the slow trials is less than that in the rapid; the fourth this difference divided by its probable error; the fifth the percent of superiority of the trials at the more rapid rate with respect to the time; and the last the ratio of this difference to its probable error.

TABLE II

EFFECT OF DIFFERENT RATES OF MOVEMENT

		Distance		Time	
Subject	Direction	% superiority slow	Differ- / P. E.	% superiority fast	Differ- / P. E.
An	Lateral	72	5.9	132	6.8
An	Longitudinal	49	5.8	169	9.5
Ap	Lateral	54	4.9	160	7.3
B	Lateral	3	0.6	270	20.0
B	Longitudinal	23	2.8	224	9.5
C	Lateral	15	1.3	248	8.5
C	Longitudinal	195	10.7	36	4.3
O	Lateral	19	4.3	235	18.6
O	Longitudinal	—26	3.2	406	14.0
Sp	Lateral	212	7.7	27	3.1
Sp	Longitudinal	34	2.1	198	7.1
Average............		59.0	4.5	191.3	9.9

It is apparent that one reacts more quickly to the more rapid movement but actually tips farther from the horizontal. Two of the subjects, *An* and *B* give introspection corresponding to this fact. However with the speeds used the time factor is much more pronounced than the distance,—191 percent on the average as contrasted with 59 percent. A detailed table shows further that the mean variation is appreciably greater on the slow than on the quick movement,—the average of the percents mean variation being 33 for the slow movement and 25 for the rapid. More errors are made on the slow movement than on the rapid,—11 percent of the total number of trials as compared with 7 percent. Thus it would appear that under the above conditions reactions to the more rapid movement are more reliable.

A further study of the main problem was made with the other equipment. The procedure was identical with the above except that the heavy spiral springs released by the ratchet were used instead of the relatively slow turning of the crank by hand. Whereas in the previous method the subject's *"Aufgabe"* was more analagous to threshold judgment, here it was more like choice reaction. Only one rate was used,—a tension on the spring which lowered the corner of the platform 3 cm. in 150 sigma. The motion was negatively accelerated. An electric vernier chronoscope or a 50th second stop watch operated by a magnet recorded the time. When the pawl left the ratchet a circuit was broken thus starting the chronoscope and the subject stopped it. The subject closed his eyes and pressed both keys down at the signal "ready."

TABLE III

DETECTION OF LATERAL VS. LONGITUDINAL MOVEMENTS AT RAPID RATES

Subject	Order	% superiority lateral	Difference / P. E. difference
An	Longitudinal	7	2.0
An	Lateral	22	5.2
Ap	Longitudinal	18	2.5
B	Longitudinal	13	3.2
C	Lateral	3	0.6
H	Longitudinal	4	1.2
H	Lateral	7	2.5
L	Longitudinal	21	6.1
L	Lateral	21	6.3
O	Longitudinal	—10	3.2
R	Longitudinal	9	2.2
R	Lateral	10	2.3
Sw	Longitudinal	3	0.8
Sw	Lateral	15	3.6
Sp	Longitudinal	10	1.7
Average		10.2	2.9

The lever was thrown about one second later and the subject lifted the proper finger according to the direction of the tilt. The noise of the apparatus of course informed the subject that he had moved but it was a case of choice reaction and there was no appreciable auditory difference between the two directions. The times show that the reaction sometimes followed after the platform had come to rest in a tilted position and sometimes before.

Table III is similar in form to Table I and gives the percent by which the average lateral reaction time is quicker than the average longitudinal and the ratio of the difference to the probable error of difference.

The same tendency is here again manifest. The differences are not as large as in the preceding method but are about 3 times the probable error and average 10 percent in favor of the lateral movement. The mean variations (not given in the table) are almost identical but slightly larger in the longitudinal. There are, however, considerably more errors on the longitudinal,— 5.8 percent of the total trials as compared with 2.4 percent. The results thus agree with the previous in showing a superiority of the lateral reactions.

The introspection of the subjects under these conditions is similar to that under the previous. *An* felt the movement largely in the head and considered the lateral a bit easier. *Ap* found the quick movement "more general and not localized in one part of the body." *B* felt it in the chair or the head. *H* felt pressure on the chair and "sensations as if the stomach were shrinking away from the clothes." The former was the more pronounced. He seldom noted sensations in the head. *L* felt the lateral "in the ears." The longitudinal was felt in the stomach and secondarily in the ears. *O* as previously judged almost entirely by tactual sensations. *R* felt it "almost entirely in the ears." *Sp* felt "nothing but the jerk." *Sw* reported the lateral as a bit easier. In general the same criteria seem involved in the more rapid movement as in the slower.

The conclusion seems justified that the average individual tilted from a horizontal position can detect a change in the lateral direction appreciably more readily (10 to 25 percent) than a change in the longitudinal direction.

In the above results the left and right reactions were averaged together and compared with the average of backward and forward. A further problem suggests itself as to left *vs.* right and backward *vs.* forward, and accordingly the results for each subject were studied with this question in mind. As to the lateral reactions there is no appreciable difference. Taking the results for a given day and tabulating the percents by which the reactions to a left tilt are superior to those to a right, the results are as follows. For the slow movement, produced by turning the crank, the average superiority of the left, including negative values is 4 percent; for the choice reactions to the movement produced by the contraction of the spring the average difference is 5 percent; for the reactions with the dep control (cf. infra)—5 percent, and with the stick control 2 percent. In all cases there is a fairly equal distribution of plus and minus values. Tabulating similarly the percents of superiority of perception of forward as compared with backward, the average difference for the slow movements is 19 percent, with about three-fourths of the values tending in the positive direction. The results are especially marked in the case of one subject. Likewise with the dep reactions 6 out of 7 cases show a superiority of the forward with an average of 7 percent. The difference disappears however in the choice reaction with the keys to the rapid movement and in the stick reactions, the average percents being only 3 and 1 respectively. The probable errors are rather high, of course, because of the smaller number of trials represented by each percent, but there is a suggestion that, with some individuals at least, perception of forward tilt is keener than that of backward.

The above results are what might be expected if one assumes a genetic explanation for perceptions of this sort. In daily life one's static organs are swayed laterally from the perpendicular very frequently, e.g. in walking. They are less often moved longitudinally. One often leans forward at a table, etc., but less frequently does he lean backward from the perpendicular. If repeated movements of the ampullar and vestibular organs in a given direction increase delicacy of perception of such movements, we should expect to find the keenest perception for lateral movements with left and right about equally efficient and perception of forward somewhat more delicate than that of backward movements,—a result which is obtained empirically.[5]

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[5] A fact of possible interest in the development of tests for aviators is the correlation between lateral and longitudinal reactions. If the lateral and longitudinal averages for all the different hours of experiment are ranked, they correlate (foot rule) to the extent of .67 ± .09 for the slow movements and .76 ± .11 for the rapid movements produced by the release of the spring. That is, an individual who has superior ability in one direction has it in the other, and one's diurnal efficiency in the various directions varies concomitantly.

IV. *Dep vs. Stick Airplane Control*

There are at present two types of airplane control in quite general use, and it seemed worth while to determine if there was any difference in a person's reactions with the two types. In the ordinary dep control a wheel is mounted vertically on a post between the pilot's knees and is grasped with both hands. Turning the wheel clockwise as viewed by the pilot banks the left wing, i.e., tilts the machine toward the right and vice versa. Moving the wheel forward, i.e., moving the upright on which the wheel is mounted, lowers the nose of the machine and vice versa. In the other control a straight stick is mounted in about the same position as the dep and grasped with one hand. Moving the top of the stick to the right lowers the right side of the airplane, moving it forward lowers the nose etc. In both cases the direction of the machine is controlled by a foot bar.

These conditions were duplicated as nearly as possible on the tilting platform. Standard specifications were observed with regard to the distance from chair to foot bar and controls, height of bar relatively to seat etc., so that the subject was in a bodily position quite similar to that of an aviator during flight.

The lateral and longitudinal experiments were made on separate hours so that a remounting of the apparatus was possible. In each instance a lever was attached from the control to the top arm of a cross-shaped upright. This upright was pivoted at the center of the cross and two fairly heavy spiral springs were fastened from the ends of the horizontal arms to the base. The lower arm closed an electric contact under slight friction when the arm was on a dead center. The springs held the cross on center and the controls in a normal position (i.e., vertical) unless the latter were moved by the subject. For the lateral movement the dep and stick were connected by a system of levers so that they moved synchronously. For the backward and forward movement they were rigidly connected, the only difference in reaction being the use of two hands on the wheel *vs.* one hand on the stick.

The experiments were conducted in much the same manner as the preceding. The movement of the platform was the same throughout,—the corner dropped with negative acceleration 3 cm. in 150 sigma. Trials with dep and stick were intermixed in a chance order during an hour,—about 30 of each. The subject sat with his hands in his lap until the experimenter said "dep" or "stick." He then grasped the control indicated and closed his eyes. A final signal "ready" was given one second before the release of the platform from the horizontal. Between trials he moved the control back to the normal position. In the lateral series using the dep he turned the wheel toward the high side, i.e., if he tipped to the left turned the wheel clockwise or when using the stick moved the top toward the high side. On the longitudinal series using either control the motion was toward the high

TABLE IV

DEP VS. STICK

Force (pounds)	Subject	% superiority stick	Difference / P. E. difference
	H	—7.4	2.4
Dep........7.10	L	0.3	0.1
Stick.......6.65	R	4.5	1.4
	H	3.9	1.3
Dep........7.15	R	7.5	2.6
Stick.......6.65	Sw	—10.0	3.4
	Average	—0.2	1.8
	H	— 7.0	0.9
	H	—12.0	1.3
Dep........12.0	L	3.4	0.9
Stick....... 4.0	L	15.0	2.0
	R	21.5	3.8
	Sw	30.0	5.6
	Average	8.4	2.4
	H	14.0	2.8
Dep........20.0	L	10.2	2.1
Stick....... 5.5	R	49.0	7.4
	Average	24.4	4.1
Dep.........3.35	R	—10.8	3.7
Stick........9.35	Sw	—20.6	5.1
	Average	—15.7	4.4
	B	— 3.7	1.9
Longitudinal....	B	— 2.7	1.0
Both equal.....	R	10.3	4.8
	R	6.5	2.0
	Sw	8.0	2.8
	Sw	— 0.6	0.2
	Sw	— 3.5	1.1
	Average	2.0	1.9

end, i.e., when tipping forward the control was pulled backward. These are the movements made in actual flight. On a given trial there was simply a choice between two reactions. A very slight motion of the control broke the electric contact so that the beginning of the reaction and not its extent was recorded. The reaction time from the beginning of the tilt until the movement of the control was taken by the vernier chronoscope or the 50th second stop watch. On the lateral motion there was one other variable involved, viz., the amount of force necessary to break the contact. This was varied by changing the arrangement of levers so that the stick required a force greater or less than or approximately equal to that of the dep.

The results are summarized in Table IV. The first column indicates the number of pounds force required to break each contact, measured by applying a spring scale at the point usually grasped by the subject. The second column gives the subject; the third the percent by which the average reaction time with the stick on a given hour is superior to (i.e., quicker than) that with the dep; and the last the ratio of this difference to its probable error. Averages are given for each combination of forces necessary to move the controls.

The table shows that when approximately the same force is necessary to break the contact there is no general tendency and the average difference is 0.2 percent. When the stick moves more easily the reactions are quicker,—when the forces are 12 and 4 lbs. averaging 8 percent quicker and when 20 and 5 lbs. 24 percent quicker. When the dep moves more easily the opposite result is found. In the longitudinal experiments indicated at the bottom of the table where the two forces are equal there is no significant difference as dep and stick are each superior in about half of the trials. A survey of the mean variation and the percentage of errors (not given in the table) shows nothing of interest except that in one group (dep 20 *vs.* stick 5.5) there is a considerably higher variation in general on the dep.

The following points of interest were mentioned in the introspection. *H* in series with the stick moving more easily than or the same as the dep thought the reactions with the former were quicker but more apt to be wrong. With the stick he would "hold still and the body would do the rest." However "the stick seemed to have more control than the dep." During the fore-period he had a kinaesthetic image of both movements. *L* liked the stick better and held it upright and let the body do the rest. After practice however he preferred the dep. Moving the stick to the right was easiest but moving it to the left was more difficult than the dep. *R*'s introspection followed directly with the objective inertia of the controls. When they were equal he thought there was little difference in his reactions; when the dep had greater inertia he reported quicker reactions with the stick and vice versa. However the "dep seemed steadier, i.e., using my two hands." *Sw* had a feeling of greater certainty with the dep. "When I reach out and take hold of it I have greater confidence. Think involuntary movements play greater rôle with stick. Body naturally goes in reverse direction and takes dep with it but with one hand it might jerk away." The most interesting point in the introspective records was the feeling of greater confidence with the dep control.

The conclusion seems justified that there is nothing in the nature of the reaction with dep as contrasted with the stick control that gives one any especial advantage over the other, provided the same amount of force is necessary in each case to overcome the inertia of the mechanism. Where such a difference in force exists the control requiring the least force yields the quickest reaction time.

Prior to the experiments under the above instructions the subjects were given a few trials with each control with instructions such as the following: "Grasp the wheel with both hands; one second after the warning 'ready' you will tip either to the right or the left; make as quickly as possible the reaction that seems most natural." With two of the four subjects who were tried thus on lateral movement there was a very marked tendency with both controls to react toward the high side as in an airplane. With the third this tendency was present with the stick but not with the dep. He spoke of associations with driving an automobile. The fourth subject reacted toward the low side with both controls. He had ridden a bicycle considerably and was reminded of it immediately and on a bicycle one steers toward the low side to maintain equilibrium. Only two subjects were tried with similar instructions on the longitudinal movement. They reacted immediately with both controls toward the high end. Thus it would seem that the types of reaction used in the standard airplane control are those which are more or less instinctive with the average individual and hence most readily automatized.

V. *Conclusions*

If an individual sitting in a chair on a platform which rocks about a point below its center is tilted from the horizontal slowly at a constant rate until the direction is perceived, or performs a choice reaction to a rapid tilt with negative acceleration, (the type of movement experienced in an airplane). the perception of the lateral is considerably superior to that of the longitudinal movements. A forward tilt is slightly more readily perceived than a backward. This indicates that an aviator is slower in perceiving and correcting a pitch of his machine as contrasted with a roll. Hence in the selection or arrangement of airplane controls if those for one direction are to be more readily manipulated such should be used for longitudinal control to compensate the aviator's natural slowness in detecting a longitudinal motion.

When tilted at various rates (without acceleration) the direction is perceived more quickly at the faster speeds but one actually tips through a greater angle. However the time factor varies much more with change of speed than does the distance factor.

Judging by the introspection both tactual and static senses are involved in perceptions of this sort. Subjective estimates of efficiency under the various conditions do not correlate uniformly with objective results.

In reacting to sudden changes of equilibrium with standard dep and stick airplane controls there is no appreciable difference in the reaction times when the forces necessary to overcome the inertia of the mechanism are equal. Where such differences in force exist the reaction time is slower with the control possessing the greater inertia.

THE APPLIED PSYCHOLOGY OF HUGO MÜNSTERBERG

By HENRY GOLDMAN, New York City

I. *Introduction*

The experiments of Hugo Münsterberg in applied psychology, due to his prominent position in the field of psychology and pedagogy, have received widespread and marked attention, and it is now proposed to examine them critically as they are presented in his book: *Psychology and Industrial Efficiency.* These experiments—for motormen, for the ship service, and for telephone operators,—will be discussed, objectively and subjectively, with reference to aim, purpose, working hypothesis, historical account, means, modus operandi, results, explanation of results, and conclusions.

"Our aim," writes Münsterberg,[1] "is to sketch the outlines of a new science which is to mediate between the modern laboratory psychology and the problems of economics." "Only in the last ten years do we find systematic efforts to apply the experimental results of psychology to the needs of society."[2] This lack of application of experimental results to practical life is different from what happened in physics, chemistry, medicine, agriculture, mining, and transportation.[3] Psychologists felt reluctant to apply their knowledge because, first, they thought that the science was not firmly enough established, and second, they were absorbed in formulating general laws. The result is that we know the working of the typical mind. In practical life we never have to do with what is common to all human beings,—we have to do with personalities whose mental life is characterized by particular traits of nationality, race, vocation, sex, age, or special interests. The study of individual differences was the most important advance toward the practical application of psychology.

Applied psychology, or psychotechnics, is not concerned with the *necessity of solving* a given problem, any more than an engineer is concerned with the need for a bridge at a given spot. His task is merely that of *solving* the problem. We can attack a psychotechnical problem in two ways: first, by studying the various human mental processes and asking for what end each mental factor can be practically useful; and second, by noting the various ends acknowledged in our society and then seeking the various psychological facts to realize these ends.[4] Or simply, the three chief purposes of business life are, first, to find the men whose mental qualities make them best fitted for the work which they have to do; second, to discover under what psychological conditions we can secure the greatest and most satisfactory output of work from each man; and finally, to determine, how we can produce, most completely, the influences on human minds which are desired in the interest of business. "In other words, we ask how to find the best possible man, how to produce the best possible work, and how to secure the best possible effects."[5] "The economic task with which we want to demonstrate the new psychotechnic method is the selection of those personalities which by their mental qualities are especially fit for a particular kind of economic work."

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[1] Page 3.
[2] Page 5.
[3] Page 8.

Present-day tests by examinations, diplomas, letters of recommendation, eliminate only the entirely unfit. This is only a negative selective process; it keeps out the unfit but does not necessarily place the fit. Social statistics show with appalling clearness what a burden and what a danger to the social body is growing because of the number who do not succeed and who by their lack of success become discouraged and embittered.[6] Münsterberg concludes that the careful selection of individual and mental characters for the various tasks of the world will insure not only greater success and gain but, above all, greater joy in the work, deeper satisfaction and more harmonious unfolding of the personality.[7]

Again, we must find what demands are made upon the mental system, and we must grade these demands. For the most important ones we must seek exact standards and experimental methods. He describes two methods of attack: first, by testing as a whole the mental process demanded by the industrial work, that is, the total activity should be performed in a gradual, measureable way; and second, by resolving the mental process into its components and testing every single elementary function in its isolated form. In the first case special apparatus must be constructed; in the second case, the psychological laboratory can use the familiar apparatus and methods. In certain industrial activities a series of psychical factors is in question which do not fuse into a total united process. In many industrial tasks just this unity is the essential condition. The testing of mental elements in such cases would be as insufficient as if we were to test a machine with reference to its parts only and not with reference to its united performance. As an illustration of the first method of attack Münsterberg presents his experiments on motormen; as an illustration of the second method, that is, the analysis of activity and testing the elementary functions, he gives the case of testing telephone operating.

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[4] Page 23.
[5] Page 27.
[6] Page 38.
[7] Page 59.

II. *Objective Report*

1. *Tests for Motormen. Problem.* Trolley car accidents have always aroused disquietude and even indignation in the public mind. Street railway companies have suffered much from indemnities amounting, in some companies, to 13 per cent of the gross earnings, and the accident cases of some corporations are as many as 50,000 per year. In 1912, the American Association for Labor Legislation held a convention to discuss accidents and their prevention, and asked Münsterberg to investigate means of selecting desirable employees.

Working Hypothesis. Münsterberg found that the reaction time of motormen who had few accidents and those who had frequent ones was not much different. Sharpness of vision is examined before entrance into service and this factor eliminated. He thought the mental process to be a particularly complicated act of attention by which the manifoldness of objects, the pedestrians, the carriages, and the automobiles are continuously observed with reference to their rapidity and direction in the quickly changing panorama of the street. He thought there are two types of men; one who waits for nearby objects to cross, and one who gets easily fatigued and while fixating a distant carriage overlooks the nearby pedestrian. Miniature apparatus would be inappropriate: feelings, ideas, and volitions would be aroused which have little in common with the processes of actual life.[8] "The essential point for the psychological experiment," Münsterberg said, "is not external similarity of apparatus but exclusively the inner similarity of the mental attitude. The more the external mechanism with which or on which the action is carried out becomes schematized, the more the action itself will appear in its true character."

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[8] Page 69.

Historical Account. Münsterberg mentions no previous experiments of this sort.

Means. (*a*) *Material.* A card, 4½ in. by 26 in. is divided into half inch squares, and represents the street. The central column is the track and the four columns on either side of the track are marked with red and black figures: 1, 2, or 3. One denotes a pedestrian who moves one step; two denotes a horse who moves twice as fast, and three denotes an automobile moving at three times the speed of a pedestrian. Black digits move parallel to the track while red ones move across and are dangerous. A red 3 which is three units away from the track, or a red 2, two units away, or a red 1, one unit away will land on the track, and the aim is to find these points quickly. A red 3 four units away is harmless, as well as a red 3 two units away. The black figures, as well as the red ones too far or too near, confuse the operator.

Twelve cards, one under another, were pressed from below against a glass plate. The plate lies in a black wooden box and is completely covered with a black velvet belt 8 in. broad, moving over cylinders at the front and rear ends of the apparatus. In the center of the belt is a glass window 4 ½ in. by 2½ in. If the front cylinder is turned by a crank the belt passes over the glass plate and the window moves over the track, revealing five units of track, full width (nine squares). A second window appears when the first has completed the card, so that the entire twelve cards can be used without interruption.

(*b*) *Subjects.* These were of three kinds: first, a number of the best motormen, who had spent twenty years or more in service, with few or no accidents; second, a large number of men with bad records; third, some whose records were neither especially good nor especially bad.

Methods. These were individual, with recorded observations.

Modus Operandi. A careful, quiet, practical explanation of the device was given, showing the test card outside the machine. Then followed a preliminary test, in which attention was called to each mistake. This procedure was repeated until the rules were completely mastered, and required only a few minutes. The motormen who took the test agreed that they really passed through the experiment with the feeling which they have on a car.[9]

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[9] Page 74.

Scoring. The shortest time for a complete test was 140 seconds; the longest, 427 seconds. Counting 10 seconds as the equivalent of one mistake, then a man with a record of 270 seconds and 2 mistakes would have a score of 290.

Results. Old well-trained motormen came to 450, which was the average. The best result was 290. 350 to 450 was considered fair; 450-550 mediocre; and over 550 very poor.

Experiments with highly educated graduate students at Harvard engaged in research work, showed much better results than those with the motormen. The scores of these students ranged from 233 to 275.[10]

"The results show a far-reaching correspondence between efficiency in the experiment and efficiency in actual service."[11] "If various interferences are taken into account, the correspondence between efficiency and the results of the tests is fairly satisfactory."[12]

Explanation of Results. The Company selected model men, but 20 to 30 years' service make them rather old men, who have no longer the elasticity of youth and are less able to think themselves into an artificial situation like this experiment. Other mental traits than ability to foresee danger points may become causes of accidents, such as a daring spirit, one who is undisciplined or one not sufficiently acquainted with local conditions. Such may show accidents and yet pass a good test. Men enter tests under a certain nervous tension and therefore may not perform as well as their mental equipment should allow.[13]

Conclusions. Motormen with more than 20 mistakes should be excluded. With a score of less than 350, mental fitness is very high; 350 to 450 is fair; more than 550 not acceptable under any conditions. A test of ten minutes would be sufficient to exclude perhaps one fourth of the number nowadays accepted as motormen. "These 25 per cent are not careless, they do not act against instructions, but their psychical mechanism makes them unfit for that particular combination of attention and imagination which ought to be demanded for the special task of motorman."[14]

2. *Tests for the Ship Service. Problem.* An officer on the bridge of a ship may bring thousands into danger by one

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[10] Page 80.
[11] Page 74.
[12] Page 77.
[13] Page 76.
[14] Page 81.

single slip of his mind. All officers know what should be done, but too many do not react in an appropriate way, when an unexpected combination of factors suddenly confronts them. Three types of officers are enumerated:

(1) The officers who are almost paralyzed when dangerous conditions suddenly threaten—they vacillate and remain inactive until it is too late to give the right order;

(2) The officer who feels only a necessity for rapid action and without clear thought acts according to the first idea which enters his mind;

(3) The officer who quickly reviews all the factors, weighs their relative importance, and with almost instinctive certainty comes to the same conclusion which he would have reached after longer deliberation.

Working Hypothesis. Münsterberg was convinced that the mental process of decision in a complicated situation, especially the rapidity, correctness, and constancy of the decision, could be made accessible to measurement by means of an artificial device.

Means. (*a*) *Material.* The material for the test consisted of twenty-four cards of the size of playing cards. On the upper half of every one of these cards there were 4 rows of 12 capital letters, namely A, E, O, U, in irregular repetition. On 4 cards one of these vowels appears 21 times, and on each of the others 9 times; on 8 cards one vowel appears 18 times and each of the 3 others 10 times; on 8 cards one vowel appears 15 times and each of the others 11 times; and finally, on 4 cards one vowel appears 16 times, each of the 3 others 8 times and besides them 8 different consonants are mixed in.[15]

(*b*) *Subjects.* Münsterberg states simply that the experiment was performed on "many persons," probably students, judging from his reference on page 93.

Modus Operandi. The person tested has to distribute these 24 cards as quickly as possible into 4 piles, so that in the first pile the letter A is most frequent, in the second the letter E predominates, and so on. The result must never be secured by counting the letters, because this would delay the decision. Time is measured in fifths of a second, from the time the first card is picked up until the last is put down.

A preliminary test is given to determine the time for ordinary sorting. Twenty-four cards, on each of which one letter: A, E, O, or U was printed once, were sorted into 4 piles.

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[15] Page 87.

The average time was 20 seconds, some taking 18 seconds, and only very slow persons needed more than 25 seconds. This maximum range of 10 seconds was regarded as unimportant because the variations in the experiment amount to more than 200 seconds.

In performing the experiment "some men lose their heads entirely, it is a painful activity for which they require a long time. Some letters stand out and appear predominant, but the next moment the attention is drawn to some other letters which appear to be in the majority. Other subjects distribute the cards in piles at relatively high speed, but the measurement of results shows many errors which would have been improbable after quiet consideration. Others, still, carry out the experiment quickly and with few mistakes, and with a feeling of an agreeable and stimulating mental activity. In all cases the subjects feel themselves under the unified impression of all 48 letters together."

Scoring. Less than 80 seconds was considered quick; 80 to 150 seconds, moderately quick; 150 to 250 seconds, slow and deliberate; 250 and over was too slow for quick action. When one letter appears 21 times and the 3 others only 9 times, the decision should be easier than when the predominant letter appears 15 times and the 3 others each 11 times. The value 4 was given to mistakes where the letter appears 21 times, value 3 was assigned to a mistake in the 18-letter cards, 2 for the 16-letter cards and 1 for mistakes in the 15-letter cards.

A sum below 5 signifies a very safe and perfectly reliable ability for decision; 5 to 12 satisfactory, 12-20 uncertain; and over 20 very poor.

To allow for both, time and mistakes, multiply the sum of the calculated mistakes by the number of seconds. If the product of the two figures is less than 400, it may be taken as an indication of perfect reliability.

Between 400-1000 indicates decisions are normal and very satisfactory.

Between 1000-2000 indicates decisions are not good but still adequate.

Between 2000-3000 indicates decisions are unreliable.

Over 3000 indicates reliability is practically absent.

Results. Among advanced students in the research laboratory the product of mistakes and seconds varied between 348 and 13,335. The lowest record, 348, was the product of 116 seconds and 3 mistakes. The aim was to compare the results of the experiment with the experiences of the various individuals which they themselves reported concerning their decisions in unexpected, complicated situations, and also with the judgments of their friends, who were asked to describe what they might expect from the subjects. The coincidence of the results with the self-characterization is frequently quite surprising.[16] "The results of the experiment in sorting the cards confirmed this self-observation in such frequent cases that it may indeed be hoped that a more extended test of this method will prove its practical usefulness."[17] It should be adapted, not only to the ship service, but also to railroading and other industrial tasks.

Conclusion. "It is clear that the real proof of the value of this method cannot be offered. This is just the reason why we selected this illustration as an example of the particular difficulty."[18]

3. *Tests for the Telephone Service. Problem.* Fourteen separate psychophysical processes are necessary in a typical telephone operator's work on one telephone call. A telephone girl cannot handle satisfactorily more than 225 calls in an hour. In extreme cases this number may rise to 300. For short periods there may be a demand for 10 calls per minute. Normally 150 calls per hour fall to each girl. The work requires a rapid, subtle activity at high tension. During the first half year, one third of those who originally entered, leave the service. They have wasted their time and energy in an attempt to learn a kind of labor which they cannot apply elsewhere, and the company has lost the salary it paid them while learning. The Bell Company employs 16,000 operators, so the problem would be a profitable one to solve.

Working Hypothesis. Münsterberg decided to resolve the activities at the switchboard into their elements and undertake the experimental testing of a whole series of elementary mental dispositions. These dispositions he resolved into three: attention, memory, and intelligence. Of intelligence, he says, "The newer pedagogical investigations speak in favor of the view that besides all special processes, or rather above all of them, an ability must be recognized which cannot be divided any further, and by which the individual adjusts his knowledge, his experiences, and his dispositions to the changing purposes of life."[19]

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[16] Page 94.

[17] Page 95.

[18] Page 92.

[19] Page 103.

Means. (*a*) *Material.* This consisted of a newspaper, some writing paper, pencils, and 48 cards.

(*b*) *Subjects.* These were 30 girls recently admitted to the telephone school whose age varied between 17 and 23 years.

Methods. These were partly individual examinations and partly group tests.[20]

Modus Operandi. Group Tests. (1) *Memory Test.* This consisted of reading to the whole class, at first 2 numbers of 4 digits, then 2 of 5 digits, then 2 of 6 digits, and so on up to figures of 12 digits, and demanding that they be reproduced as soon as a signal was given.

(2) *Attention Test.* This consisted of crossing out a particular letter in a connected text. Every woman in the class received the same first page of a newspaper of that morning. The newness of the content was expected to distract attention. At a certain time a bell was sounded and each girl was expected to start a new column. The object was to discover how many correctly crossed letters were done, how many overlooked, and how recognition and oversight were distributed.

(3) *Intelligence Test.* This consisted of reading a series of 24 pairs of words, taken from the sphere of the experience of the girls, of which the two members always logically belong together. Later one word of the pair was read, and the girls were requested to write the word which belonged with it in the pair. The results were compared with the rank of the girls as estimated by their teachers from experience with them as students.

(4) *Space Perception.* This test consisted of dividing first the long and then the short edge of the folio sheet into two equal halves by a pencil mark.

Individual Tests. (5) *Rapidity of Movement.* This was tested by causing the student to make, with a pencil on paper, zigzag movements of a particular size during 10 seconds from one signal to another.

(6) *Sorting Cards.* A pack of 48 cards were sorted into 4 piles as quickly as possible. The time was measured in fifths of a second.

(7) *Accuracy of Movement.* This test was performed by trying to reach, with the point of a pencil, 3 different points on the table in the rhythm of metronome beats. On each of the three places a sheet of paper was fixed with a fine cross in the middle. The pencil should strike the crossing point. One

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[20] Page 101.

demanded the full extension of the arm; the other two had to be made with half-bent arm. This test was introduced because the hitting of the right holes is important in switchboard work.

(8) *Association Test.* Six words, like "book," "house," "rain," were called, and the student was expected to reply with the first word which came into her mind; the time was measured in fifths of a second.

Results. (1) *Memory Test.* It is useless to consider those with more than 10 digits. Münsterberg took only those with 8, 9, or 10 digits. There were 54 possible mistakes. The smallest number of actual mistakes was 2; the largest, 29.

(2) *Attention Test.* In the attention test, some crossed out many "a's" and overlooked many; some overlooked few but crossed out less than others; some did poor work at first but soon reached a high level; others did good work at the beginning but became slow and careless. There was much fluctuation of attention.[21] The smallest number of correctly marked letters was 107; the largest number was 272. The duration of the test was 6 minutes. The smallest number of overlooked letters was 2; the largest number was 135, which was quite isolated, however. The errors of letters wrongly cancelled varied between 5 to 60. The best results were a case of 236 letters marked and only 2 overlooked, and a case of 257 marked with 4 overlooked.

(3) *Intelligence Test.* The highest number of words reproduced was 22 out of a possible 24. Smallest number of words remembered was 7.

(4) *Space Perception.* The range of mistakes was between 1 and 14 millimeters.

(5) *Rapidity of Movement.* No report.

(6) *Sorting Cards.* The time varied between 35 and 58 seconds.

(7) *Accuracy of Movement.* Many could not perform the movement quickly enough.

(8) *Association Test.* The time for the 6 words varied between 9 and 21 seconds.

The grades of each girl for each experiment were calculated. The same candidate, for example, stood 7th in memory, 15th in letters marked, 3rd in letters overlooked, 21st in word pairs grasped, 11th in reference to exactitude of space perception, 16th in association time, and 6th in sorting cards. The average of all the grades of each girl was then taken, and the girls arranged in order of rank.

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[21] Page 102.

The results of average standing in the tests compared with average standing in school after 3 months was on the whole satisfactory.[22] The telephone company had mixed with the class a number of women who had been in service a long while and had even been selected to teach in the telephone school. These women stood at the top of the list. Correspondingly, those who stood lowest in psychological rank had in the meantime been found unfit in practical service and had left the company. The agreement was not perfect. One of those low in rank was doing fair work, and two of those high in rank were reported to be only fair by the telephone officials.

II. *Subjective Report* (*Criticism*)

Aim. This work of Münsterberg's is one of the first attempts to "place the psychological experiment systematically at the service of science and industry,"[23] as its author proclaims, and it promptly devotes itself to two low grade occupations: motorman and telephone operator, if pay is a fair criterion. The author informs us that "the careful selection of individual mental characters for the various tasks of the world will insure not only greater success and gain but above all, greater joy in the work, deeper satisfaction, and more harmonious unfolding of the personality."[24] How can this be possible? Can people take great joy in their work and attain more harmonious unfolding of the personality on low wages, even if that is all that vocational guidance allots them?

Working Hypothesis: "The essential point for the psychological experiment is not the external similarity of apparatus but exclusively the inner similarity of the mental attitude. The more the external mechanism with which or on which the action is carried out becomes schematized, the more the action itself will appear in its true character." First, this is contrary to the doctrine which is basic for all scientific research: *no conclusion is valid which does not study the conditions under which the results are obtained.* Münsterberg admits this himself when he says, "The chief danger, moreover, lies in the fact that those who are not accustomed to psychological research are easily misled. They fancy that such an experiment can be carried out in a mere mechanical way without careful study of all the conditions and accompanying circumstances. Thereby a certain crudeness of procedure may enter which is not at all suggested by the test method itself. The psychological layman too seldom recognizes how many other psychic functions may play a rôle in the result of the experiment besides the one which is interesting him at the moment. The well-schooled laboratory worker almost automatically gives consideration to all such secondary circumstances. While his experiments may refer to the process of memory, he will yet at the same time carefully consider the particular situation as to the emotional setting of the subject, as to his attention, as to his preceding experience, as to his intelligence, as to his physiological condition, and many other factors which may have indirect influence even on the simplest memory test."[25] The quotation is an almost perfect statement of the problem of scientific research, but Münsterberg himself promptly forgets to consider the persons upon whom his experiments are performed, with regard to emotional setting, attention, preceding experience, intelligence and physiological condition. In the motorman test, for example, he apparently neglects the factor of attention entirely, because in the laboratory the motorman is not disturbed by sounds, colors, or moving objects which might distract his attention on a trolley car. And with regard to intelligence, in his telephone tests he himself states that "the newer pedagogical investigations speak in favor of the view that besides all special processes, or rather above all of them, an ability must be recognized which cannot be divided any further, and by which the individual adjusts his knowledge, his experiences, and his dispositions to the changing purposes of life."[26] In the motorman test the worst college student made a better record than the best motorman. The inevitable conclusion is that either this test is an intelligence test, pure and simple, or else college men should become motormen. We fancy there will be no great rush by college graduates to supplant the present occupants of the motorman's box.

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[22] Page 108.
[23] Page 3.
[24] Page 38.

Means. (1) *Material.* The material is adequately described.

(2) *Subjects.* The subjects are not described with much detail. In the ship service tests they are merely mentioned as "many persons."

Methods. Individual tests are more valid than group tests. Münsterberg uses individual tests throughout except in the first four tests for the telephone service. But, the lack of records in complete form, as discussed later, nullifies in this case the superiority of the individual tests over the group tests.

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[25] Page 114.

[26] Page 103.

Modus Operandi. The chronology of the tests is completely lacking. The plan of each test is given with complete detail, and is probably the best part of Münsterberg's work. The material is uniform for each test. The execution is discussed with sufficient detail in all cases except where he states that "the motormen agreed that they really pass through the experiment with the same feeling which they have on the car."[27] A feeling is an indefinite quantity, and it is questionable, in view of the discussion above, whether the statement of the motormen is correct. The scoring is elaborate and carefully thought out. The records are not given completely enough with regard to quality and quantity, and the presentation of what is given is merely in descriptive form. There are no tabular or graphic records.

Results. The validity of the results is questionable, always, when records of experiments are presented in so fragmentary a manner, since the student has no way of exercising his judgment in verifying the validity of the results. For instance, in the ship tests, we are told that "the coincidence of results (of experiment) with self-characterization is frequently quite surprising."[28] It would be interesting, to say the least, to have the original data! Or, in the motorman tests, we are told that "if various interferences are taken into account the correspondence between efficiency and the results of the tests is fairly satisfactory,"[29] and that "the results show a far-reaching correspondence between efficiency in the experiment and efficiency in actual service."[30]

Explanation of Results. There is no explanation of the results in the ship service and telephone girl tests. In the motorman tests Münsterberg virtually admits that the test he used is valueless to satisfy his aim, which was to eliminate accident. He says, "Other mental traits than ability to foresee danger points may become causes of accidents, such as a daring spirit, one who is undisciplined or one not sufficiently acquainted with local conditions. Such men may show accidents and yet pass a good test. Men enter tests under a certain nervous tension and therefore may not show so well as their mental equipment should allow."

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[27] Page 74.
[28] Page 94.
[29] Page 77.
[30] Page 74.

Conclusions. In the ship service and telephone tests Münsterberg draws no conclusions, but the motorman tests, he claims, will enable us, in a 10 minute test, to exclude one fourth of those nowadays accepted as motormen, whose "psychological mechanism makes them unfit for that particular combination of attention and imagination which ought to be demanded for the special task of motorman."[31] If his device is considered legitimate for the purpose of his test, in spite of the belief that it does not reproduce the actual surroundings and working conditions of a motorman's task, then the statement just quoted should be convincing of its failure, because what is this but an acknowledgement that the cause of the elimination of one fourth of the men would be their sheer lack of intelligence! .

The reader's conclusion after a study of the tests, inevitably becomes that the most significant factor in all tests is intelligence. The conclusion is, also, that most of the tests measure the intelligence of the individual rather than any other of his characteristics. And finally, may not we add that the diagnosis of the individual's ability to succeed is correct in direct ratio to the amount of intelligence which he possesses and registers in the experiment!

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[31] Page 81.

WORK OF THE COMMITTEE ON CLASSIFICATION OF PERSONNEL IN THE ARMY

EDWARD K. STRONG, JR.

Purpose of Personnel Work.—True efficiency in war, as in industry, consists largely in getting men into the right places—in assigning them to those positions where each can serve with greatest effectiveness. Owing to differences in experience, technical skill, specific training and temperament, a man may be worth in one position many times what he is in another. Intelligent personnel work is intended to match each man's abilities with his task, to place him in that position where he is most valuable.

Progressive industrial concerns now appreciate the necessity for special departments to exercise this direction over their employees in order that they will be of greatest value to the company.

When war was declared, the Secretary of War and The Adjutant General recognized the necessity for determining the abilities of the drafted men of the Army in order to place them where they could serve most effectively. The construction expert, for instance, is needed in the Engineers, not in the Cavalry; the drill press operator in the Ordnance, not in the Quartermaster's Department; the map maker in the Signal Corps, not in the Infantry.

The task of analyzing the men, of classifying them by trade and by specific occupations within the trade, and of assigning them to those branches of the service and to those positions in the regular infantry divisions where they can serve best—this task was assumed by The Adjutant General with the assistance and co-operation of The Committee on Classification of Personnel in the Army.

The Committee.—The Committee on Classification of Personnel in the Army is a civilian body created by the Secretary of War on August 5, 1917, and working under the jurisdiction of The Adjutant General. Its general function has been to furnish counsel and to carry on research work concerning personnel problems.

The Committee has been composed of psychologists interested in individual differences and of employment managers.

The Director of the Committee is Dr. Walter Dill Scott, Director of the Bureau of Salesmanship Research at Carnegie Institute of Technology, Pittsburgh, Pennsylvania. It has had in its service for longer or shorter periods of time the majority of the leading employment managers in the country. And it has used in addition the services of many prominent sales managers, specialists in job analysis, and statisticians.

The Committee acts in an organizing and advisory capacity. Its relation to the Army is much the same as that of an Expert Public Accountant called in by an industrial concern to install a new system of bookkeeping. When the system is installed and properly operating in an Army Division, and when the Military Officers are thoroughly trained to assume full charge, the Committee withdraws and leaves its operations entirely in the hands of the proper military authorities, except so far as the Secretary of War and The Adjutant General may retain its services as a business house will retain the services of the public accountant after his system has been installed in order to make sure it continues its functions properly.

The Personnel Work.—Through the instrumentality of the Committee, an organization has been built up in all the army divisions in this country by which all enlisted men and commissioned officers are classified according to their occupational qualifications and also in the case of commissioned officers according to their military qualifications. The cards upon which these records are entered are filed for the enlisted men in a Division Personnel Office and for the officers in the office of the Commanding General of the Division. Because of this system, thousands of men have been assigned to specific work in the army for which their previous experience especially fitted them. A good example of this service comes from one of the Southern cantonments. A Colonel of a regiment of engineers came to the Division Personnel Officer for help in finding a man for the most responsible position an enlisted man can fill, that of Regimental Sergeant Major. The Colonel was looking for a mature man of commanding presence and force of character, with military experience. He wanted some one who had had clerical experience, preferably as an accountant, and who also had had engineering training. The Personnel Officer found him a man who met even these varied specifications. As a lad this man had enlisted in the Navy and risen to the rank of Machinist's Mate. He had then left the Navy and worked for two years or so as a stenographer and bookkeeper; and at the time of his enlistment in the National Guard Army last fall he was a senior in the Engineering School of

Tulane University. Moreover, he was a *private in that Colonel's own regiment.*

Up to the present time a man has been classified on the basis of a personal interview. The interview was first conducted by the company commander, but after a fair trial that procedure was discontinued. It is now made by officers who have been especially instructed for this work and are referred to as members of the interviewing Board. This system has given very satisfactory results. In one transfer of 800 men to a Pioneer regiment it was estimated that 97% of the men came up to the specifications of the Colonel. But in some cases where specialists were needed the system has not worked so well.

The Trade-Test Division.—In order to improve still further the system it is contemplated to establish in each cantonment *trade-tests.* A series of carefully graded questions are being selected in such a way that a novice will be unable to answer any of the questions, an apprentice a few only, a journeyman most of the questions, and an expert all of them. In addition, performance tests are being developed so that the interviewer's estimate of the man's fitness along any occupational line will be based upon actual demonstration of his handiwork. A small hand book, "Aids for Interviewers" (Form T. T. 1., Preliminary Edition), prepared by Mr. Mark M. Jones, has already been distributed to Personnel Officers. Two groups of experts are being employed in the Trade-Test Division of the Committee on this work—the first in developing the questions and tests on the basis of the best sources of information available in the country; the second devoting its energies to careful and painstaking try-outs of the tests upon groups of apprentices, journeymen and experts so as to ascertain just how they work out in practise.

Another phase of the work of the Trade-Test Division has been the development of a book, "Trade Specifications," by Mr. J. J. Swan, which gives an exact comprehensive definition of some 600 different trades together with a statement of the trades which can be drawn upon as substitutes. A comprehensive index to this book makes it possible to locate, regardless of the term that may first be thought of, any one of the specifications. A simpler index is also furnished Personnel Officers for reference when interviewing men. This index of occupations has become the standard list of terms by which occupations are referred to by all army personnel officers, particularly when submitting requisitions to the War Department.

Tables of Occupational Needs of Units in a Division.—In order that Divisional Personnel Officers may be more thoroughly informed as to just what types of skilled and semi-skilled men are needed in the various units of a division a series of tables have been prepared showing just what each unit requires. For example, Table 23-b shows the needs of a radio company of a Field Signal Battalion. In one column is given the various grades and duties of the 75 men according to the Tables of Organization and in a paralell column is given the civil occupation which most nearly fits the man to undertake the military duty, thus:

Table of Organization	Skilled	Partly Skilled	Occupation and Code
1 Master Signal Electrician	1		Radio Operator and Constructor (31 w plus wc) plus engineering knowledge
6 Sergeants, 1st Class			
1 First Sergeant			
5 Chiefs of Sections	5		Radio Operator (31 w)
9 Sergeants			
1 Mess Sergeant	1		Caterer (40 c)
1 Supply Sergeant	1		Merchant or stockkeeper (42, 18 s)
7 Company Duty	7		Radio Operator (31 w)
15 Corporals			
(1 Company, Clerk)	1	1	Clerical worker who can tpyewrite (35 g plus 39 t)
	1		*General mechanic with small* apparatus experience (6 mc)
12 Company Duty		12	Radio operator or Telegrapher (31 w, t)
	etc.		

These tables represent a vast amount of work, being based on the reports of many officers in Washington and in the field, including French and English officers. Dr. W. V. Bingham is largely responsible for this present form.

Extension of Work to Staff Corps.—This personnel work is rapidly being extended to the Staff Corps troops. On March 10th, the system was in operation in the Coast Artillery, a large part of the Quartermaster Corps, including 2,000 civilians at Washington, portions of the Signal Corps, and plans were being made for similar work in the Ordnance Corps. It is expected that the system will be completely installed in the Quartermaster and Signal Corps in a very short time. Representatives of the Committee in Europe are planning for its adoption throughout those units of the army in France which sailed before the system was installed in them.

Central Personnel Bureau.—In conjunction with the occupational classification of enlisted men there has been established in Washington a Central Bureau which receives reports twice a month as to the number of skilled and semi-skilled men in each occupation, in the National Army, National Guard, and the Regular Army camps. This Central Bureau has furnished the information as to where skilled men were to be found in the army on the basis of which the General Staff has organized a large number of technical units for such assignments; 109,487 men have been individually selected by Division Personnel Officers on the basis of their occupational fitness. Of this number 59,793 have been handled through the Central Bureau since its establishment. These totals do not include requisitions for men which did not specify occupational or military qualifications.

This number includes over a hundred capable physicists and meteorologists imperatively needed by the Aviation Section; chemists for gas defense work; surgical instrument repairmen; bacteriologists (including one of the ablest men in America for the particular duties required of him by the Sanitary Corps in France); refrigeration experts for the food service of the Quartermaster Corps; 5,000 mechanics and technicians for the Aviation service, and two-thirds that number for the Land Division of the Signal Corps; 480 crane operators, 1,230 foresters, and thousands of railroad builders, railway shop mechanics, and other workmen for Engineer regiments already overseas; 1,600 accountants, inspectors, machinists, gunsmiths and other ordnance specialists; 275 French-speaking chauffeurs; and an entire regiment of 2,600 French-speaking men for Army Headquarters, to serve mainly as military police.

The Central Bureau has also compiled statistics showing the resources of the army along occupational lines. These figures have called attention to shortages along certain lines, such as, airplane mechanics, auto repairers, blacksmiths, canvas workers, farriers, gas engine repairmen, harness makers, etc.

Committee on Education and Special Training.—In order to meet these deficiencies through the technical training of men a Committee on Education and Special Training was appointed by the Secretary of War on February 10. The Committee is composed of Col. Hugh S. Johnson, deputy provost marshal general; Lieut. Col Robert I. Rees, of the General Staff; and Major Grenville Clark, of The Adjutant General's Department.

The five advisory members of the Committee are: Dr. Charles R. Mann, of the Carnegie Foundation for the Advancement of Teaching and the Massachusetts Institute of Technology; Dr. James R. Angell, of Chicago, Dean of the faculty of the University of Chicago; Mr. J. W. Dietz, of Chicago, Director of Education, Western Electric Company, President of the National Association of Corporation Schools; Mr. James P. Munroe, of Boston, a member of the Federal Board for Vocational Education (which appointment will include the interests of the trade schools and schools of secondary grade), and Dr. Samuel P. Capen, of Washington, specialist in higher education.

"Under the direction of the Chief of Staff the functions of the committee shall be: To study the needs of the various branches of the service for skilled men and technicians; to determine how such needs shall be met, whether by selective draft, special training in educational institutions, or otherwise; to secure the cooperation of the educational institutions of the country and to represent the War Department in its relations with such institutions; to administer such plan of special training in schools and colleges as may be adopted."

"It is estimated that within the next 6 months 75,000 to 100,000 men will be given intensive training in schools and colleges. These men will be drawn from the armed forces of the Nation, the men now in training camps or about to be called thereto, and the registrants under the selective draft act. It is expected that most of the men selected for technical training will be taken from among the men who have registered under the selective draft law and who are awaiting training and the call to the colors."

When a requisition is received at the War Department this Committee on Education and Special Training, acting for the Chief of Staff, determines whether the men shall be obtained from the Army in the United States, or through the selective draft, or otherwise. If from the first source, it determines in terms of the records of the Central Bureau from what divisions the men may be obtained, as described above.

The War Service Exchange.—If the Committee on Education and Special Training determines that the men shall not be obtained either from the army or through the draft, it may turn to several sources. One of these is the War Service Exchange, another phase of the activity of the Committee on Classification of Personnel. This Exchange was organized by order of The Adjutant General on January 18, 1918. This is a directing agency for those desiring to enter the service whether in civilian, enlisted or commissioned capacity. The War Service Exchange is able to accomplish this because it is constantly informed of the personnel needs of the Staff Corps. A total of 11,196 written offers of service and 1,580 personal interviews of a similar nature have been handled so far. Over 3,000 of these men have been placed in government service. The War Service Exchange also assists the Staff Corps in active campaigns to secure men of special abilities, through connections with Universities, Engineering Societies, Commercial Organizations, the Department of Labor, and other agencies of a similar character. On March 15th it took over the work of the Inter-Collegiate Intelligence Bureau. The War Service Exchange is in a sense a liaison agency between the War Department and the Department of Labor. It is charged with keeping informed as to such needs of the Staff Corps as the Department of Labor is prepared to supply through its Federal Employment Service and the Public Service Reserve. It is charged with reporting such needs to the Department of Labor.

Rating of Officers.—Another activity of the Committee on Classification of Personnel is the development of accurate methods for the rating of officers and candidates for commissions in the Officers Training Camps. This work is based on the rating scale devised by Dr. Walter Dill Scott for use in selecting salesmen under the auspices of the Bureau of Salesmanship Research at Carnegie Institute of Technology. The rating scale for officers was first used in eight of the Officers Training Schools, first series. Since then it has been adopted for all such schools and was used in connection with the third series in selecting candidates for the schools as well as for rating them while in attendance. Its use has been further extended so that all line officers in America are now rated by it, as well as all Coast Defense and Quartermaster officers. A somewhat different scale has been adopted and is now in use for all civilian employees in the Quartermaster Corps at Washington. At the present time other scales are being developed for use in the Signal Corps, Air Division, one for the pilots and observers and another for administrative officers.

Cooperation with the Provost Marshal General.—A plan for securing usable information concerning the nine million registrants was prepared and submitted to the Provost Marshal General and its provisions were partially embodied in the Questionnaire issued by the latter to the men within the draft age. The Committee also formulated plans for an occupational analysis and card index of all the registrants by which relative drafts could be made. In the main this plan is now being put into operation.

Army Paper Work.—A constructive study of army paper work so far as it has to do with the personnel of the army was made. Suggestions for reducing this paper work are under consideration.

Intelligence Tests.—Assistance has been given to the Surgeon General's Department in devising and giving a series of general intelligence tests at four of the National Army Divisions. This work is now to be extended to the entire army. Record of the intelligence ratings is kept on the enlisted man's and officer's Qualification Card.

Selection of Aviators.—Dr. E. L. Thorndike has carried on an extensive investigation as to the relationship between success in flying and the items in the present application blank used by Examining Boards. The results are not at present available for publication. Further investigations are being conducted at present. It is believed that ere long a much more adequate method for the selection of aviators will be available whereby a larger per cent of men can be selected from the start who will make good in this very important phase of army work.

Work in the Navy.—Dr. Raymond Dodge has devoted his energies to methods of selecting and training men for certain specialized duties in the navy. Several such assignments have been successfully carried out; others are still under way.

The active members of the Committee on March 10th were:

Walter Dill Scott, Director, Director, Bureau of Salesmanship Research, Carnegie Institute of Technology, Pittsburgh.

E. L. Thorndike, Chairman, Professor of Educational Psychology, Teachers' College, Columbia University, New York.

W. V. Bingham, Exec. Sec., Head of Division of Applied Psychology, Carnegie Institute of Technology, Pittsburgh.

J. R. Angell, Dean of the Faculties, University of Chicago, Chicago.

R. C. Clothier, Director of Employment, A. M. Collins Mfg. Co., Philadelphia.

W. R. De Field, Superintendent of Systems, Montgomery, Ward and Co., Chicago.

Raymond Dodge, Professor of Psychology, Wesleyan University, Middleton, Conn.

Edward K. Strong, Jr., Professor of Psychology, George Peabody College for Teachers, Nashville, Tenn.

J. B. Watson, Major, U. S. R. Signal Corps, Professor of Psychology, Johns Hopkins University, Baltimore.

R. M. Yerkes, Major, U. S. R., Surgeon General's Staff, Professor of Psychology, University of Minnesota, Minneapolis, Minn.

Inactive and former members are:

H. L. Gardner, Director of Employment, Dupont Powder Co., Wilmington, Del.

J. F. Shepard, Assoc. Professor of Psychology and Supervisor of Building Construction, University of Michigan, Ann Arbor, Mich.

L. S. Terman, Professor of Educational Psychology, Stanford University, Calif.

Military associates of the Committee are:

R. I. Rees, Col., General Staff, U. S.; Grenville Clark, Major, A. G. D. U. S. R.; E. N. Sanctuary, Major, A. G. D. N. A.; L. H. Whiting, Major, A. G. D. N. A.; B. J. Kempter, Capt., Artillery, N. G.; J. Perry Moore, Capt., A. G. D. N. A.; S. C. Garrison, 1st Lieut., A. G. D. N. A.

Civilian associates of the Committee are: 1. *In the Office at Washington.*

P. J. Reilly, Supervisor of Camp Work, Employment Manager, Dennison manufacturing Co., Framingham, Mass.

S. J. Gummere, Office Manager, Paymaster, P. B. and W. R. R. Co., Philadelphia.

A. C. Robinson III, Supervisor of Personnel Statistics, Architect, Sewickley, Pa.

R. B. Perry, Professor of Philosophy, Harvard University.

W. L. MacCoy, Acting in Mr. Robinson's place during his absence, Lawyer, MacCoy, Evans & Hutchinson & Lewis, Philadelphia.

Miss M. L. Free, Assistant Office Manager, Asst. in Psychology, Carnegie Institute of Technology, Pittsburgh.

E. S. Robinson, Statistician on Rating Scale, Asst. in Psychology, University of Cincinnati, Cincinnati.

F. Meine, Statistician on Rating Scale, Fellow in Psychology, Carnegie Institute of Technology, Pittsburgh.

Miss M. D. Hughes, Filing and Accounts, Asst. Registrar, Margaret-Morrison Carnegie School, Pittsburgh.

2. *Supervisors in Camps.*—The following employment managers have been used for varying lengths of time in installing and supervising the personnel work in the camps. Those starred have served at this writing four or more months.

C. F. Axelson, Northwestern Mutual Life, Chicago.

Philip Brasher, Chili Exploration Co., New York City.

*Wm. Clark, International Harvester Co., Chicago, Ill.

N. F. Dougherty, Pennsylvania Railroad, Philadelphia, Pa.

O. L. Davis, Jr., O. L. Davis Lumber Co., Trinidad, Colo.

J. W. Dietz, Western Electric Company., Chicago, Ill.

C. R. Dooley, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

A. A. Goes, Goes Lithographing Co., Chicago, Ill.

R. B. King, Hyatt Roller Bearing Co., Newark, N. J.

*W. S. MacArthur, Armour and Co., Chicago, Ill.

S. B. Mathewson, Southern Bell Tel. and Tel. Co., Atlanta, Ga.

D. J. O'Connor, Swift & Co., Chicago, Ill.

*R. H. Puffer, Larkin Co., Buffalo, N. Y.

W. A. Sawyer, American Pulley Co., Philadelphia, Pa.

J. E. Sheridan, Crane Co., Chicago, Ill.

*A. J. Turner, Washington Water Power Co., Spokane, Wash.

*Kendall Weisiger, Southern Bell Telephone and Telegraph Co., Atlanta, Ga.

C. J. Whipple, Hibbard, Spencer, Bartlett Co., Chicago, Ill.

3. *Civilian Associates in the Division of War Service Exchange.*

Winslow Russell, Agency Manager, Phoenix Mutual Life Insurance Co., Hartford, Conn.

J. J. Coss, Assistant Professor of Philosophy, Columbia University, New York. In charge, Personnel Sub-Division of the General Administrative Division, Quartermaster Corps.

C. W. Jones, Mgr. Service Dept., Erwin & Wasey Co., Chicago.

H. F. Magee, Charge of Contract Division, Phoenix Mutual Life Insurance Co., Hartford, Conn.

C. L. Procter, Traveling Salesman, Moore Grocery Co., Tyler, Texas.

S. H. Roth, Student at University of Chicago, and President of Undergraduate Council, University of Chicago.

4. *Civilian Associates in the Division of Trade Tests.*

M. M. Jones, Supervisor of Personnel, Thomas A. Edison, Inc., Orange, N. J.

J. J. Swan, Consulting Mechanical Engineer, Philadelphia, Pa.

L. B. Hopkins, Manager's Assistant, General Electric Co., Pittsfield, Mass.

Beardsley Ruml, Instructor in Psychology, Carnegie Institute of Technology, Pittsburgh, Pa.

T. R. Stocksdale, Engineer and Assistant Manager, W. P. Perry Electric Co., N. Y.

J. C. Chapman, Professor of Educational Psychology, Western Reserve University, Cleveland.

T. L. Kelley, Assoc. Professor Psychology, Columbia University, New York.

J. A. Balcom, Mechanical Engineer, Bayonne, N. J.

W. P. Schatz, Secretary Manager of Middlesex County Farm Bureau, Waltham, Mass.

Max Watson, Civil Service Examiner, Sacramento, Calif.

T. M. De Blois, Production Engineer, Plainfield, N. J.

R. F. Evans, Employment Manager, J. H. & C. K. Eagle, New York.

A. D. Fell, Business Training School Salesman, New York.

J. N. Field, Railroad Secretary, N. Y.

A. C. Rader, Production Supervisor, Orange, N. J.

L. L. Thurstone, Assistant Professor of Psychology, Carnegie Institute of Technology, Pittsburgh, Pa.

Rudolph Pintner, Associate Professor of Psychology, Ohio University, Columbus, Ohio.

T. J. Kirby, Professor of Secondary Education, University of Pittsburgh, Pa.

TRAINING COURSE OF THE AMERICAN STEEL & WIRE COMPANY

By Charles R. Sturdevant

No arguments are needed in these days to show why salesmen or other men holding responsible positions should, in some manner, be given special training and be encouraged to become the very best of which they are capable. This principle has become so thoroughly recognized and so firmly established that today hundreds of our leading business and industrial concerns either have well established courses, or are casting about to discover some effective way of training those employees holding responsible positions.

With concerns housed in one building, or in a single group of buildings, the problem is comparatively simple, for the men to be trained can be brought together once or twice a year or oftener and given a thorough training by having them confer with the several department heads, listen to lectures, and make inspection trips through the mills. But when the mills are widely scattered, and when widely differing products are made in them, the problem becomes a difficult one.

The American Steel & Wire Company employs from thirty to forty thousand men and women in its offices and mills. From the crude raw materials mined from the earth, this Company makes all the common grades of steel and it works this up into every conceivable kind and size of wire classified as common product, in its mills located in the Chicago, Cleveland, Pittsburgh and Worcester districts. From this wire it produces immense quantities of nails in great variety, from the needle pointed bill poster's tack to the ponderous boat spike, as well as barbed and woven wire fencing, etc. The Company also makes high grade steels of special analyses from which it produces telegraph wire, piano wire, rope wire, phonograph needle wire and motor springs and a practically endless list of highly specialized articles. In addition, wire of pure copper, both bare and insulated and the products of copper wire are produced in the Worcester District in great variety and heavy tonnage. As the business expanded and the Company grew, there developed an insistent need of some thorough, systematic and uniform method of training its employees in all the matters pertaining to this varied and extensive business.

Prior to this period, for example, a salesman selling some one or two products in a territory remote from any mills would have little or no incentive to interest himself in the other products of the Company and would probably have a limited knowledge of the materials and processes involved in the manufacture of his own specialities. Also a mill man devoting all his time and energies to the production of some one or two products would have very little opportunity of learning the other phases of the business closely related to his own. The problem consisted of devising means for quickly and economically giving these men who had for years been confined to narrow lines of activity, a broad general knowledge of the whole steel and wire business.

That it must be an intensive course of study was soon manifest. Those in charge of organizing the course had many misgivings as to whether middle-aged, practical and non-technical men wholly unaccustomed to study could stand several weeks of intensified application to study or whether they would be willing to submit themselves to such a course. The work as later developed showed that these misgivings were not justified.

The course was instituted in 1912, and it has met with such success that we trust a description of the work will be of general interest to the readers of the JOURNAL OF APPLIED PSYCHOLOGY.

As originally organized the course was intended for veteran salesmen only, but shortly afterwards it was found advisable to slightly modify the course and make it suitable for semi-executives from other departments as well. The course is intended only for employees who have been in our employ for a considerable period—not for beginners. It is carried on under the immediate supervision of three competent instructors taken from the organization, and requires practically all of their time.

Two of the instructors had been in the employ of the Company for a long period and had acquired a very thorough practical knowledge of all phases of the wire business, one as superintendent of mills, the other as an expert in testing and inspecting of wire products. These two men conduct the classes through the mills. The third, who has had immediate charge of the work, had been a collegiate teacher in earlier years and had spent the last few years in engineering and technical work.

The class spends one week in the Pittsburgh district, three in the Cleveland district and two and one half at Worcester, Mass. To complete the course requires six and one half weeks of intensive study and application on the part of the men. All traveling expenses are paid by the Company and a daily allowance is made for living expenses.

Each class has been organized by the secretary of the Training Course Committee. About a month before the date set for the beginning of a class, the secretary would write to the several department heads of the Company requesting them to appoint a definite number of men from their respective departments for this particular class. Each department head would in turn call upon his lieutenants for candidates, and in a week or so a class of about twelve men would be organized. About seven such classes have taken the course each year. The twelve men constituting a class are purposely chosen from different parts of the United States, and from various departments. Ordinarily there have been about two men from the Operating Department, one from the Accounting, one from the Order Department, and eight from the Sales Department. In general these men differ widely in age, experience and capabilities. The close association, for six and one-half weeks, of such a diversified group of men, is in itself a liberal education.

When the men are first notified of their appointment to a given class most of them anticipate the work with dread and some have tried to have their appointment postponed, having heard exaggerated reports of the training being unpleasant and the work difficult. On the other hand, a few have eagerly sought the opportunity of taking the course and have welcomed the summons when it came. But before the end of the first week of the course every man with scarcely an exception has stated that he was glad he came and that he would not have missed it for anything.

In most cases the moment a man is selected to take this course of training he assumes a new line of thought. The very fact that he is chosen to be specially trained gets him out of the rut of every day happenings in his sphere of activity. It is either a mark of appreciation for past efforts or the belief that he can become a more valuable man. In either case it is now for him to show whether or not he can measure up to the opportunity. With this in mind he begins the training with a different mental attitude from that which he held toward his regular work day after day, and for these reasons the effect of sending a man to different cities to be trained may be well worth the cost. In either case the man's selection as being capable of absorbing an intensive course of instruction is a mark of distinction which has its effect even on those who are apparently callous to such influences.

The first desire of the average man is to make good and having been selected for a special course which involves the use of his brains as well as those of his observing powers he goes to the new task in a receptive mood. He may be a little skeptical as to the ability of anyone teaching him more than he already knows of his work, but he believes it is up to him to learn something new or to explain why he could not do so. Thus his mind is more alert than before and being one of a class of twelve, all having the same opportunities and studying the same lessons further places the man on his best efforts and best behavior.

The men selected for a given class are given about three weeks' previous notice, and are, at the same time, assigned suitable preparatory reading matter. At the appointed time they assemble at Pittsburgh, Pa. where they will meet an instructor who organizes them into a class and requires them to fill out a registration blank.

Nearly all of the first week is taken up in making inspection trips through various steel and wire mills in or near Pittsburgh, in order to afford the men an opportunity of obtaining a general idea of how all our products are made and of the work to be taken up in the course, and also to inspire them with a desire to go more thoroughly into the details.

During the second week the class studies steel making. From step to step they learn how the ore is converted into pig iron, how this is transformed into the several grades of steel, and finally how the steel ingot is made into a wire rod. During the following week they are taught how the various grades and kinds of wire are made from rods. They become familiarized with our so-called common products, and with the process of manufacture. During the balance of the course they are shown and taught how wire is given special treatments in order to secure certain desired properties and to avoid certain other harmful properties; how the wire is tested, and how it is fabricated into the various commodities, common and special, made by the Company—such as woven wire fencing, wire nails, wire rope, electrical wires and cables and so on.

The real work of the course, it will be observed, begins with the second week, after the men have become fairly well acquainted with each other, and with the work to be covered. Each day's work from then on (except on Saturdays) is divided into four periods: a forenoon mill inspection trip, a noon-day lecture and discussion, an afternoon quiz and evening recreation and study.

Each morning the class, under the guidance of an instructor and one or two mill foremen, is taken slowly through some one mill where the students witness the details of the process involved in making some one product or some group of closely related products, about which they studied the evening before; the making of rope wire, for example.

In this manner the men are given every opportunity of making a detailed study of all essential materials, processes and mill equipments. This systematic method of making mill inspection trips is very much more effective than the old way of sending the men alone into the mill to wander about aimlessly.

Just before, or after, the midday lunch, the mill superintendent, or department expert, will carefully review the morning's work, and afford the men an opportunity of asking questions and entering a general discussion. During the latter part of each afternoon, another instructor subjects the members of the class to a searching quiz, which helps greatly to organize the knowledge of the day's work, and to fix it in their minds. Each member of the class is encouraged to answer fundamental or leading questions, and if he cannot answer, another member is given an opportunity on the same question. During the session, the instructor clearly settles all important questions of doubt and forcibly brings out the salient points of the lesson. The fundamental scientific principles are described whenever possible. This quiz enables the instructor to determine very quickly the points which need to be especially emphasized, and it soon indicates to him the particular men who need personal help. It further gives each man an opportunity of measuring himself with others who have had equal privileges with him of study and mill inspection, and it is a strong agency to stimulate him to his best efforts.

At the close of each quiz, a small, specially prepared printed booklet, is given to each man, covering the following day's work, and the men are requested to study this thoroughly during the evening, even though they may not clearly understand it all, as an aid to the following day's work. It will be seen that the course is laid out on the budget system—a full day being devoted to some one subject. The various subjects, each of which is treated in a separate booklet or lesson, are, of course taken up in logical order from day to day, proceeding from the simple to the more complex, the whole making one complete story.

On several occasions, the class is given regular set lectures by department heads. These cover the work being done by the Accounting, Order, Transportation and Welfare Departments, and matters pertaining to the organization as such. These are not only enjoyable diversions, but they serve to coordinate the activities of the various departments, and to bring the whole personnel of the Company into closer touch and sympathy.

STUDENT RECORD

SHORT TRAINING COURSE

Name in full, John Doe
Home Address, Grand Rapids, Mich.
Business Address, Chicago, Ill.
Present Occupation, Fence Dept.
Class No. . Date Started, July 30, 191 . Date Finished, Sept. 13, 191 .
Age, Years, 36. Nationality, American
Employed by Company, 9 years. Married or Single, Married.
Departments employed in during service, Sales Dept.
Education — Common School, 10 years.
High School, 2 years.
Technical School, Name, ... years
Technical Course taken . . . . Degree (if any) . . . .
Practical Experience in Mills, Shops or Laboratories. . . . .
Remarks: A large, fine appearing fellow, pleasing appearance and personality, clear thinker, independent and above board. A fine character and natural leader of men. Was greatly interested in and much benefited by the course.

Examination Grades

1st week	2d week	3d week	4th week	5th week	6th week	7th week	Average
V. G.	G	E	—	V. G.	V. G.	—	V. G.

Observed Characteristics

Enthusiasm	E	Personality	E
Energy	E	Approach	E
Ambition	E	General Knowledge.	V. G.
Thoroughness	V. G.	General Ability	E

(E, means Excellent. V. G., Very Good. G, Good. F, Fair. P. Poor)

Five written examinations are given, usually on Saturday mornings and at the close of the course, one whole day is devoted to a general oral review of the completed course. The weekly examinations cover the work of the week. No catch questions are asked, only ten or twelve fundamental questions. These examinations are conducted on the honor system. They have given our men more concern than all else and have constituted one of the strongest incentives to diligent study. The papers are carefully reviewed and graded, and they help to make up the final report of each man, similar to the one shown. Copies of this report are sent to those officials of our Company who are directly interested.

In all our work we have attempted to do three things thoroughly. First, to train the men to *think straight* in the conception and application of essential fundamentals; second, to impart some information and specific technique to each man in his own line, and finally to give to all a more intelligent idea of the Company business as a whole.

While it is an intensive course of study, the work has been so laid out and is so handled as to require a minimum amount of time and effort on the part of the student. And while a great majority of the men are wholly unused to study or to close application at the time they enter the course, they do, in spite of these seeming handicaps, acquire a surprising amount of useful knowledge, even in so short a period as six and one-half weeks.

The limiting of the course to six and one-half weeks instead of being a disadvantage has proved to be a benefit, and here the element of psychology comes in. With a long course there would be no particular incentive to finish the lesson today. There is always a tomorrow, and it is a long time to the end of the course.

Limiting the course to six ond one-half weeks changes this attitude completely. Here is a certain definite number of lessons to be learned in a much shorter period, and evidently there is no time to be lost or wasted. The necessity for crowding in a full course in a given time, and that a short one, puts the student on his mettle and shows him the need of concentrating his mind on the course. All else must wait till this is done.

As to the resulting benefits both to the men and to the Company, they are many. Aside from the direct result of a greatly increased useful knowledge of the technique of the business, they are given a broadened view point and a quickened interest in their work. The free exchange of views during the course acquaints many for the first time with the difficulties which men in other departments have to overcome. This new knowledge is conducive to better team work and makes the men less critical. The course stimulates self confidence, loyalty and good fellowship. It enables our salesman to take an affirmative positive attitude towards his prospective customers not possible for one who does not actually know what he is talking about. He is in a position to advise his customers as to kinds or grades of materials which should be used for certain purposes or processes. In the minds of many it has created a new and wholesome respect for real knowledge; it has clearly brought out the difference between facts and opinions. In conversation and correspondence the men fairly bubble over with enthusiasm and with confidence in their ability to discuss steel and wire matters. The one great regret of the older men who have taken the course is that they were not given this opportunity earlier in life.

VOCATIONAL TESTS FOR RETAIL SALESWOMEN

By Elsie Oschrin, A.B., Barnard College, Columbia University

The purpose of this investigation was to obtain, if possible, a vocational correlation for sales ability of the lower grade, particularly of that type found in a retail department store.

The subjects of the experiment were a group of eighteen saleswomen in one of the largest department stores of New York City, who formed a class in salesmanship. These women had all been selling for an appreciable length of time and had been chosen for instruction by their respective buyers because of the promise they showed in their work. They were employed in various departments of the store, linings, veilings, notions, art embroidery, infants' wear, dresses, waists, underwear, handkerchiefs, etc., and received salaries that (including commission) varied from $16.00 to $8.00 per week.

The group was tested with a list of thirteen tests, eleven of which were standard tests. Two were devised by the experimenter, and were based upon a similar test used by Münsterberg[1] upon salesmen.

The standard tests were

1. Trabue Completion-scale A
2. Number Checking
3. Opposites
4. Mixed Relations
5. Verb Object
6. Substitution
7. Color Naming
8. Hard Directions
9. Knox Cube
10. Cancellation
11. Association-Kent-Rosanoff

The new tests were rearrangements tests. Two lists—one of animals, the other of cities—were presented, with however the letters of the word in each case in random order, thus, skunk-snkuk, Bombay-yabmbo. The lists were arranged in an order of increasing difficulty and the group instructed to reconstruct the words, passing regularly down the list, but skipping any word that presented too great difficulty. They were limited to ninety seconds for each list and were informed as to whether it was animals or cities they were to look for.

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[1] Burtt, H. E. *Journal of Applied Psychology*, Sept., 1917.

REARRANGEMENT TESTS

Animals		Cities	
snkuk	skunk	yabmbo	Bombay
niol	lion	sarip	Paris
rede	deer	lndono	London
tgrei	tiger	tosbon	Boston
barze	zebra	ksnaas	Kansas
selwae	weasel	gabdda	Bagdad
bnsio	bison	beuqca	Quebec
leum	mule	tyor	Troy
seomu	mouse	latcatuc	Calcutta
shroc	horse	caghioc	Chicago
goroanka	kangaroo	tnotrne	Trenton
delopra	leopard	karnwe	Newark
haplente	elephant	bylana	Albany
kmyeon	monkey	lbnire	Berlin
duonh	hound	revdne	Denver
ycteoo	coyote	nanpaolsi	Annapolis
lqriurse	squirrel	tnosuho	Houston
kunmpchi	chipmunk	remitlabo	Baltimore
rotligala	alligator	tormlean	Montreal
laglroi	gorilla	sbucouml	Columbus
tinram	martin	satleet	Seattle
lettru	turtle	fatrdohr	Hartford
clreoicdo	crocodile	dartplnod	Portland
peatnole	antelope	rimdonhc	Richmond

The remainder of the tests, except color-naming and Knox Cube, were given as group tests and in orthodox fashion, the time limit being that of the first subject finished for all but the Trabue Completion, for which four minutes were allowed. In the association test everyone was permitted to complete the hundred associations. Color naming and Knox Cube were given to each member of the group individually. The group was tested over a period of six weeks, at ten o'clock in the morning.

Seven objective ratings of each member of the group were obtained. These were

1. *Buyer's estimate.* The buyer under whom each girl worked and who was personally well acquainted with her work was visited and asked to construct a scale of sales ability and to locate the girl upon it. The scale was made by asking the buyer to place at 1 the best salesgirl he had ever known, at 5 the poorest, at 3 one midway between the extremes, and at 2 and 4 women between 1 and 3 and 3 and 5 respectively. Then he was asked to compare the girl in question with the people on the scale and to locate her by this comparison. The group was then arranged in order of merit according to the positions of the individuals upon these scales.

The accuracy of this final order is somewhat doubtful, inasmuch as the varying tempers and temperaments of some fourteen buyers, their antagonism to, interest in, or indifference to the experiment and the experimenter, and their varying standards of sales-ability make for many sources of error, especially when an attempt is made to render their divers judgments into a homogeneous whole.

2. *Salary.* The group was ranked according to salary. This ranking is not as valuable as at first glance it may seem to be, inasmuch as length of service, age and department are as potent wage determinants as actual sales ability.

3. *Teacher's ranking for salesmanship.* This ranking was made by the teacher of the salesmanship class at the end of the six weeks course, during which time the teacher had seen the group every day. It was the result of her knowledge, through actual observation, of their selling on the floor, her observation of their class performance, of an examination given by her at the close of the course, and of a detailed report submitted to her by the buyer and section manager of each woman.

4. *Ranking for General Intelligence* by the teacher.

5. *Average ranking.* The average of the ranks in salary, and buyer's and teacher's estimate of sales ability was calculated and the group arranged in an order of merit according to this average position.

6. *General rating.* At the time of testing each woman was interviewed and her age, education, nationality, i.e., whether native or foreign born, selling experience, period of employment in her present position, weekly salary, average weekly commissions, and the department in which she worked, were ascertained. This information was placed upon a card, one for each woman, together with her rating for salesmanship and intelligence by the teacher and for salesmanship alone by the buyer. These cards were submitted to thirty-seven students of a graduate course in Advertising and Selling at Columbia University with instructions to arrange the cards in an order of merit, judging each girl for her sales ability on the basis of all the information on each card.

7. The seventh, called *Selected Group Judgment,* is a refinement of the sixth. Of the group of thirty-seven students twenty-two had had experience in either hiring or handling sales people or had actually been salesmen themselves, fifteen had had absolutely no experience whatsoever. These fifteen

were eliminated and an average ranking for each saleswoman obtained from the judgments of the smaller selected group.

The value of these seven measurements varies. By far the most valid, it would seem, are the teacher's judgments of the group, based as it is on an all round and fairly intimate knowledge of all the subjects. Its value is further confirmed by the fact that it shows a correlation of only +.28 with the judgments for general intelligence, which indicates that it was something other than general intelligence itself upon which ability to sell was judged. That this other something was a quality recognized by the teacher and buyer in common and may therefore be inferred to be actual sales ability is evidenced by the fact that the coefficient of correlation between the teacher's judgment of sales ability and the buyers' was +.43.

The teacher's judgment of intelligence is valid, of course, and interesting, but is not so valuable for the purposes of this experiment. The reasons for the unreliability of salary and buyers' estimates have already been discussed and need not be repeated. The average rank, composite that it is, of salary, buyers' estimates and teacher's judgment of sales ability strikes a point somewhere between the invalidity of the first two measurements and the accuracy of the last.

The last two measurements and particularly that of the selected group present a more truly composite picture than the average ranking. They are based on a complete sales history of each individual, are made by fairly competent judges, and may be considered of equal value with the teacher's judgment of salesmanship, with which indeed the sixth correlates +.86 and the seventh +.89. The two judgments—teacher's and group—supplement and correct each other, for what the one gains by personal knowledge is equalled in the other by the added accuracy and freedom from errors of individual judgments which group averages give.

The scores made in the thirteen tests were ranked for each test and correlated with the seven objective ratings by the Spearman formula.[2] Table I below presents the coefficients of correlation between performance in these tests and actual sales ability as indicated by the seven objective methods of ascertaining it.

The correlations of the tests with the buyers' estimates and with salary indicate for the most part a chance relationship and are consequently not significant. Some such results were to have been expected from the unreliability of both methods

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[2] Used throughout in the experiment.

TABLE I.[3]

Tests	Buyer	Teacher Salesmanship	Teacher Intelligence	Salary	Average	General Rating	Selected group
Completion	—.04	.40	.81	.01	.12	.43	.51
No. Checking	.29	.43	.15	—.32	.13	.37	.41
Opposites	.26	.65	.52	.30	.55	.59	.62
Mixed Relations	—.07	.50	.69	.05	.32	.55	.66
Rearrang. Animals	.05	.45	.58	.23	.31	.53	.52
Rearrang. Cities	—.32	.38	.35	.07	.17	.30	.42
Verb Object	.20	.21	.55	.03	.29	.51	.47
Substitution	—.03	.15	.20	—.36	—.13	.13	.35
Color naming	.07	.31	.30	.11	.21	.39	.31
Directions	—.004	.41	.64	—.12	.14	—.25	.09
Knox Cube	—.13	.12	.61	—.06	.06	.27	.43
Cancellations	.49	.41	.01	—.33	.16	.28	.42
Association—Individ	.53	.01	—.32	.57	.48	—.30	—.33

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[3] The probable errors for these Coefficients are as follows:

Probable errors for Formula $r = I - \frac{6\Sigma D^2}{n(n^2-1)}$ when n is 18.

r	P. E.	r	P. E.
.00	.166	.50	.125
.10	.165	.60	.107
.20	.159	.70	.085
.30	.151	.80	.059
.40	.139	.90	.031

TABLE 2

TEAM CORRELATIONS

Sales Ability						Intelligence	
1. Teacher		2. Selected Group		3. Av. of Teacher and Selected Group			
Opposites	.65	Opposites	.62	Opposites		Knox Cube	.61
Relations	.50	Relations	.66	Relations		Relations	.69
Rearrang. Animals	.45	Rearrang. Animals	.52	Rearrang. Animals		Rearranged Animals	.58
No. Checking	.43	Completion	.51			Completion	.81
Cancellation	.41	Verb-Obj.	.47			Directions	.64
Directions	.41						
.76		.69		.62		.75	

of estimation. Individuality of association alone shows a relatively high positive correlation with these two, +.53 with the buyers' judgment and +.57 with salary.

The other measurements, in which we seem justified in placing a greater degree of confidence, show coefficients whose general character is much higher and positive. The average ranking of course produces a coefficient that is not so low as salary and buyer coefficients and not so high as that obtained from the teacher's estimate. It is an interesting and pertinent fact worthy of note here, that, whereas the group judgment is fairly high throughout, in almost every case correlation with the new order obtained from the selected group raised the coefficients to a marked degree.

If from the tests we select those which gave the six highest correlations for the teacher's judgment of sales ability, those which gave the five highest for intelligence and also those which gave the five highest for selected group judgment, average the rankings of each of these groups and correlate these averages with their respective measurements we obtain a group which correlates +.76 with sales ability as judged by the teacher and a slightly different group which correlates +.69 with sales ability as judged by the selected group.

Three tests of these two groups are identical for both groups, —mixed relations, opposites, and rearrangement of animals. When the average ranks of these three tests were ranked and correlated with the ranks obtained from an average of the teacher's judgment for sales ability and that of the selected group a coefficient of .62 was obtained. The team for intelligence gives a coefficient of .75. See Table 2.

TABLE 3.

JUDGMENT CORRELATIONS.

	Salary	Teacher Sales.	Teacher Intell.	Average	General Rating	Sel. Group
Buyer........	.24	.43	—.01	.76	.67	.47
Salary........	...	.20	.02	.63	.28	.19
Teacher S....	...	...	.28	.73	.86	.89
Teacher I....	...	...	...	.34	.68	.77
Average......	...	...	...	...	.88	.74
General Rating	...	...	...	...	...	.97

The evidence throughout the experiment seems to indicate that the type of sales ability called for in a retail department store is a fairly measureable function in terms of mental tests, with which it shows a definite tendency to correlate positively. Vocational selection may very well be made upon the evidence of performance in such tests, and our results point to three in particular,—mixed relations, opposites and rearrangement of animals—which may be used with an accuracy of +.62 in such selection. Of course the group used in this experiment is too small for the absolute values obtained in correlation to have any binding significance, but the direction, at least, in which these values point, is unmistakable and indicates that the field of retail salesmanship is one open to much profitable investigation by the vocational psychologist.

OBSCURITIES IN VOTING UPON MEASURES DUE TO DOUBLE-NEGATIVE[1]

By ELEANOR ROWLAND WEMBRIDGE and EDGAR R. MEANS

In the Oregon election of November 7, 1916, a curious vote was registered by the people. Although the negroes have had the vote in the U. S. A. since the Federal Amendment giving them that privilege in 1865, the state constitution of Oregon, denying them that right, has never been amended to conform with the Federal law. There are not many negroes in Oregon, and there is no more race feeling than in any northern state. The negro votes freely at elections without intimidation of any kind. Since November 1912, the negro woman has also enjoyed that privilege. But in the 1916 election an attempt to repeal the restriction against the negro vote, which existed only on paper, and give him the formal state right which he already had in reality, failed. Despite the negro vote on the measure, despite the fact that its passage was considered a foregone conclusion, and despite the surprise on the part of most of the voters at finding that this inconsistency existed in the Oregon constitution, a negative vote was registered by a small majority, and the negro remains deprived of voting rights by the state constitution, although he still votes unmolested as before.

The outcome of the vote on this measure occasioned considerable comment, because of the uselessness of the negative vote, and the difficulty in interpreting the state of mind which lay behind such a failure to see the issue clearly. The generally accepted explanation was, however, that the voter had been confused as to whether he was voting on his convictions that the negro should or should not be deprived of the vote, or whether he was voting on a measure repealing the restriction against him. It could readily be possible that a voter would vote " No " meaning, " I do not believe in restrictions against negroes," whereas his " No " would really register against the removal of the restriction. The general surprise of the voting public upon the outcome indicated clearly that it represented no body of opinion, and that it was probably largely accidental.

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[1] From the Psychological Laboratory of Reed College, Portland, Oregon.

Another measure on the same ballot was the "Anti-Compulsory Vaccination" law. This was a hotly contested measure, in which the doctors and educated classes in general were ranged on one side against enthusiastic vaccination fighters on the other, backed by certain faith healing sects. The law was passed repealing the former compulsory vaccination law, but many of the voters protested afterwards that they had voted exactly opposite to their convictions. Their "Yes" meant to them, "Yes, I believe in compulsory vaccination" whereas it had registered, on the contrary, "Yes" to the repeal of the compulsion.

Other examples might be cited in recent elections, such as the recent vote against Woman Suffrage in Ohio. An act of legislature, known as the Reynolds Act, had given the women the right to vote for presidential electors. A referendum brought the matter again before the voters. So indignant were many of the suffragists against the calling of a referendum, and so much was said against it, that there was confusion on the part of the voter, as to whether he was voting "No" against having a referendum, or "Yes" for the approval of the Reynolds Act. The success of the referendum, and the failure of the act were laid by many to this confusion of the issue.

Such being the state of affairs in various elections, it was *decided to test the matter in the psychology laboratory.*

As a preliminary, 16 propositions were taken, and expressed in 6 different ways; simple affirmative, simple negative (with a word like *prohibit*), simple negative (with the word *not*), double negative (with words *not* prohibit), double negative (with *prohibit* prohibit), and double negative (with not not). These various forms were supposed to cover the ways that negatives, in either an open or disguised form, are made use of on ballots. Thus a measure that "minors shall not be allowed to smoke," that "minors shall be prohibited from smoking" are both single negatives; that "minors shall not be prohibited from smoking," that "it is prohibited to prohibit minors from smoking" and that "minors shall not be forced not to smoke" are all substantially double negatives. Ninety-six such propositions were tried upon 4 members of an experimental class. The measures were read, and the length of the interval between the time the experimenter finished reading and the moment the subject registered his vote was recorded. The subjects were given the list twice, and an average of the time intervals was taken. The latter were as follows:

1. Simple affirmative, 1.7 sec.
2. Single negative (prohibit, etc.), 3.0 sec.
3. Single negative (not), 3.7 sec.
4. Double negative (not prohibit), 6.4 sec.
5. Double negative (prohibit prohibit), 8.23 sec.
6. Double negative (not not), 8.25 sec.

This result was merely an indication of the increase in difficulty in passing a judgment. We wished however to get votes based upon convictions, in which the ballots would be cast as nearly as possible as they are in reality, and in which we could measure the variation in the vote due to the introduction of negatives in the statement.

We therefore prepared two printed ballots upon which were ten measures of general interest to the voters of Portland. On the first ballot the ten measures were worded affirmatively and set up in the form of an ordinary ballot. On the second ballot the same ten measures were so worded as to contain negatives in varying numbers. Every effort was made to approximate as nearly as possible actual voting conditions. The subjects to be tested were given the first ballot, and required to vote according to their convictions on each of the ten measures. At a later time they were given the second ballot, and asked to vote according to their convictions again, emphasizing the fact that they were to express the same attitude toward the measure in both cases. If they had changed their minds on the way they wished to vote, they were asked to indicate this in the margin, but the marked ballot was to indicate an identical point of view as regards the measure in question. Nothing was said about the presence of negatives or the purpose of the experiment, but the subjects were merely asked to sign their names to the two ballots. The method permitted group experimentation, and the ballots were submitted to seven classes. This included two college classes, three business college classes, one class of Y. M. C. A. students, and one class of high school students. Because of the necessity of having exactly the same groups give their time to the experiment on two different days, it was impossible to add to these the groups of business men and of day laborers which we had hoped to include. The groups included men and women (since Oregon women are voters) and the voters ranged from 18 to 27 years of age.

SIMPLE AFFIRMATIVE STATEMENT

Name .... Date ....

INSTRUCTIONS: Please write your name and date on the appropriate blanks above. Vote your convictions on the following measures, regardless *of whether you think they are now laws or not.* Please vote without consultation with others.

Mark X after the word Yes or No, according to your convictions, at the left hand side of the page and under each measure.

1. COMPULSORY MILITARY TRAINING. PURPOSE.—To provide for *three years of compulsory military training* for every able-bodied citizen (male) of the United States, between the ages of 21 and 27 years. Vote Yes or No.

Yes..............
No..............

2. DIRECT ELECTION OF PRESIDENT. PURPOSE.—An amendment to the Constitution of the U. S. providing for the election of President and Vice-President by direct vote of the people. Vote Yes or No.

Yes..............
No..............

3. EQUAL SUFFRAGE AMENDMENT. PURPOSE.—An amendment to the Constitution of the United States providing for the extension of the right of political suffrage to women on the same terms as now enjoyed by men. Vote Yes or No.

Yes..............
No..............

4. AMENDMENT TO CONTROL MANUFACTURE AND SALE OF ALCOHOLIC LIQUORS. PURPOSE.—An amendment to the Constitution of the State of Oregon providing for the regulated manufacture and sale of four per cent alcoholic liquors. Vote Yes or No.

Yes..............
No..............

5. UNIVERSAL EIGHT HOUR WORKING DAY. PURPOSE.—To provide for an eight hour working day for both men and women in all industries in Oregon. Vote Yes or No.

Yes..............
No..............

6. FOUR CENT FARE. PURPOSE.—A municipal ordinance initiated by the people of the city of Portland, providing that all common carriers doing business in the said city of Portland shall be required to provide four cent service for transportation from one section of the city to another. Vote Yes or No.

Yes..............
No..............

7. CAPITAL PUNISHMENT. PURPOSE.—To provide for the re-establishment of the death penalty in the State of Oregon as a punishment for the crime of murder in the first degree. Vote Yes or No.

Yes..............
No..............

8. SAILING PRIVILEGES. PURPOSE.—An act permitting American citizens to sail only on ships flying the American flag. Vote Yes or No.

Yes..............
No..............

9. SHIP ARMAMENT. PURPOSE.—To authorize the arming of American ships engaged in foreign trade. Vote Yes or No.

Yes..............
No..............

10. MUNICIPAL ELECTRIC PLANT. PURPOSE.—A bill referred to the people of Portland by the Commissioners of said city, providing for the purchase or construction of a municipal light and power plant and refusing all further franchises to private companies. Vote Yes or No.

Yes..............
No..............

COMPLEX NEGATIVE STATEMENT

Name .... Date ....

INSTRUCTIONS.—Fill out blanks above.

Vote your convictions as voted before. If you desire to change your vote as cast before, please indicate such change by crossing out the number at the beginning of the measure so changed. Thus,

1. ANTI-COMPULSORY MILITARY TRAINING. PURPOSE.—To provide that an able-bodied male citizen of the United States over the age of 27 years, shall not be prohibited from enjoying the rights and privileges of citizenship who shall not have had three years of military training. Vote Yes or No.

Yes..............
No..............

2. DIRECT ELECTION OF PRESIDENT. PURPOSE.—An amendment to the Constitution of the United States abolishing the provision of the Constitution prohibiting the President and Vice-President from being elected by direct vote of the people. Vote Yes or No.

Yes..............
No..............

3. EQUAL SUFFRAGE AMENDMENT. PURPOSE.—An amendment to the Constitution of the United States providing that all the rights of political suffrage now enjoyed by men, shall not be prohibited to women. Vote Yes or No.

Yes..............
No..............

4. AMENDMENT FOR CONTROLLED MANUFACTURE AND SALE OF ALCOHOLIC LIQUORS. PURPOSE.—To amend that section of the Constitution of the State of Oregon, prohibiting the manufacture and sale of alcoholic liquors, by prohibiting the State of Oregon from prohibiting the manufacture and sale of four per cent malt liquors. Vote Yes or No.

Yes..............
No..............

5. UNIVERSAL EIGHT HOUR DAY. PURPOSE.—To abolish the law abolishing the law prohibiting an employer from employing labor in the State of Oregon for more than eight hours per day. Vote Yes or No.

Yes..............
No...............

6. FOUR CENT FARE. PURPOSE.—A municipal ordinance initiated by the people of the city of Portland, to abolish the ordinance of the city of Portland prohibiting the Commissioners of the city from requiring all common carriers doing business in the city to charge a four cent fare. Vote Yes or No.

Yes..............
No...............

7. CAPITAL PUNISHMENT. PURPOSE.—An act to abolish that section of the Constitution of the State of Oregon abolishing the death penalty as a punishment for murder in the first degree. Vote Yes or No.

Yes..............
No...............

8. SAILING PRIVILEGES. PURPOSE.—An act to prohibit Congress from prohibiting the President from requiring American citizens sailing for foreign countries to take passage on ships flying the American flag. Vote Yes or No.

Yes..............
No...............

9. *SHIP ARMAMENT. PURPOSE.—An act repealing the law abolishing* that enactment of Congress which prohibits the arming of ships engaged in foreign trade. Vote Yes or No.

Yes..............
No...............

10. MUNICIPAL ELECTRIC PLANT. PURPOSE.—A Bill referred to the people of the city of Portland by the Commissioners of said city, providing for the purchase or construction of a municipal light and power plant, and repealing the law prohibiting the Commissioners from refusing franchises to private companies. Vote Yes or No.

Yes..............
No...............

The table shows the number in each group experimented on; the percentage of confusion (by which we mean that the vote on the second ballot contradicts the vote on the first) on each of the ten phrasings for each group and the average percentage for each group as well as for each measure from all groups.

The table indicates that on no measure was the percentage of confusion in the second vote less than 12, and the lowest average obtained from any group was 28. Too much importance should not be attached to the variation in confusion in

TABLE

	Percentage of confusion by groups on each measure										Average percentage in each group
	1	2	3	4	5	6	7	8	9	10	
College students (64 subjects)....	30	17	12	18	51	34	17	33	42	29	28
High School students (22 subjects)..........	31	36	13	59	45	45	13	50	31	31	35
Preparatory students (21 subjects) Y. M. C. A.	23	28	47	42	57	57	38	47	47	28	41
Business College students (107 subjects)	46	54	36	45	63	57	42	54	34	45	47
Average percentage all groups.......	35	37	28	36	56	48	30	47	37	36	

the different groups of subjects, because of the smallness of the groups, and neither can we attach too much to the ranking of the different measures, since the range of percentages is so large that another set of samples would doubtless show wide fluctuation. The main value of the investigation, in our judgment, is the evidence that varied groups of voters are confused by the negative statements of a measure. Our conclusion is of course based on the assumption that all confusion was caused by the presence of negatives on the second ballot, and that the voters remembered their vote on the first ballot. Since the measures on the first ballot were stated as simply as possible, and the experimenter made every possible effort both by answering questions and making suggestions, to make the meaning of all the measures clear, we feel that this assumption is justified.

The obvious recommendation, after such an experiment is, that the clauses on a ballot, stating the purpose of a measure, should be stated affirmatively. To the argument that a negative statement confuses both sides equally, and therefore its influence is negligible, we would answer, that this reduces the vote to a chance rather than an intelligent vote, and furthermore, it gives an advantage to the NO vote, because of the well recognized tendency to vote No when in any doubt about the measure.

In closing, I will illustrate this recommendation by an example. In 1914 a vote was cast in Oregon on the Eight Hour Law for Women. Since the object was to *prohibit* the employment of women for more than eight hours, it would have been easy to so word the ballot. This might have aroused in the voter an antagonism against a more than eight hour day, and the protest might have expressed itself in a No vote, which would however have registered against the voter's convictions, since to prohibit the employment of women more than eight hours, demanded a Yes vote. Many votes on the prohibition measure have been so confused.

The purpose as stated however was "To amend sections— and—of Lord's Oregon Laws, so as to limit the hours of labor for female workers, etc." In this way, the affirmative idea was emphasized, instead of the negative idea of prohibiting something, and the conviction YES, for the measure meant an affirmative vote, and vice-versa. By this means, we believe, the actual convictions of the voting population were registered at the polls.

A DRAWING COMPLETION TEST

By RUDOLF PINTNER and HERBERT A. TOOPS, Ohio State University.

The completion test has long been a favorite test of intelligence, and it has proved itself of great value. The underlying idea of any completion test is that the subject shall supply some part which has been omitted and which is essential to the whole. Ebbinghaus seems to have been the first to have made use of the completion test idea as applied to language and since his time the language completion test has developed considerably and has proved to be one of our most valuable tests. The most notable extension of the language completion test is the series of completion test language scales devised by Trabue.[1] Binet seems to have been the first to have used the completion test idea as applied to pictures, using it in the test of "Missing Parts" in the Binet-Simon Scale. Evidently this test proved a useful one, because it has been retained in all the revisions and modifications of the Binet Scale. The picture completion test converted into a performance test is found in Healy's Picture Completion Test.[2] Here the response of the subject is limited by the number of blocks provided with the test, whereas in language completion tests the response of the subject is limited only by the extent of his vocabulary.

The Test

We have attempted to use the picture completion test idea for group testing. The response of the subject is in this case drawing the missing part of the picture, and it is for this reason that we have called it a Drawing Completion Test.

No language is required in performing the test. Furthermore, language is unnecessary in giving the test, although it will of course be used in giving the test to hearing English-speaking children. Because the language factor is eliminated in this test, it should prove very useful for foreign or deaf subjects.

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[1] Trabue, M. R. Completion Test Language Scales. *Teachers College Contributions to Education*, No. 77, 1916, pp. 118.

[2] Healy, W. and Fernald, G. M. Tests for Practical Mental Classification. *Psychological Monographs*, No. 54, 1911, and also, Pintner, R. and Anderson, M. M.—The Picture Completion Test. *Educ. Psych. Monographs*, No. 20, Warwick and York, 1917.

Figure 1 shows the test as originally planned. It consists of 25 pictures each of which lacks an essential part. We attempted as far as possible to have the pictures so constructed that an essential part should be missing, that is, a part without which the picture would not be complete. The missing part should not be something that might very well be in the picture, but does not form an essential part of it. For example, Picture No. 17, is an example of what we consider a poor picture inasmuch as the picture is in itself complete, although there might very well be a knife added. The addition of the knife, however, is not essential to the unity of the whole. The picture is a unit as it stands at present. Picture No. 17 is the poorest of our group; all the others conform to the principle laid down above.

Presentation of the Test

The examiner, after distributing the test sheets and warning the children not to open the sheets until he gave the signal, drew on the blackboard the face of a man similar to Picture No. 1, but putting in two eyes and omitting the mouth. He then called a child to the blackboard motioning or telling the child, according as he was a deaf or hearing child, to finish the picture. What is required is obvious at once to all children, with the exception of those who are very retarded. The signal to begin was then given and the children were allowed to work for eight minutes. From previous trials this time was found to be adequate for practically every child; it is long enough for the older children to study out every picture and for the youngest to attempt all those within their ability.

Method of Scoring

A score of three points for each correct response was arbitrarily decided upon. Partial credits of two and one points were given for partially correct responses. Each deviation from the correct response was noted and recorded as it appeared. In this way a scoring guide was compiled; this is too lengthy to be printed here. In general it may be said that, when the missing part was inserted in the wrong place, a score of two was given; and when something else "that made sense" was added to the picture but the missing part was omitted, a score of one was given.

Results

The children in two hearing schools and in one deaf school were tested. Table I gives the percentile scores by age for the

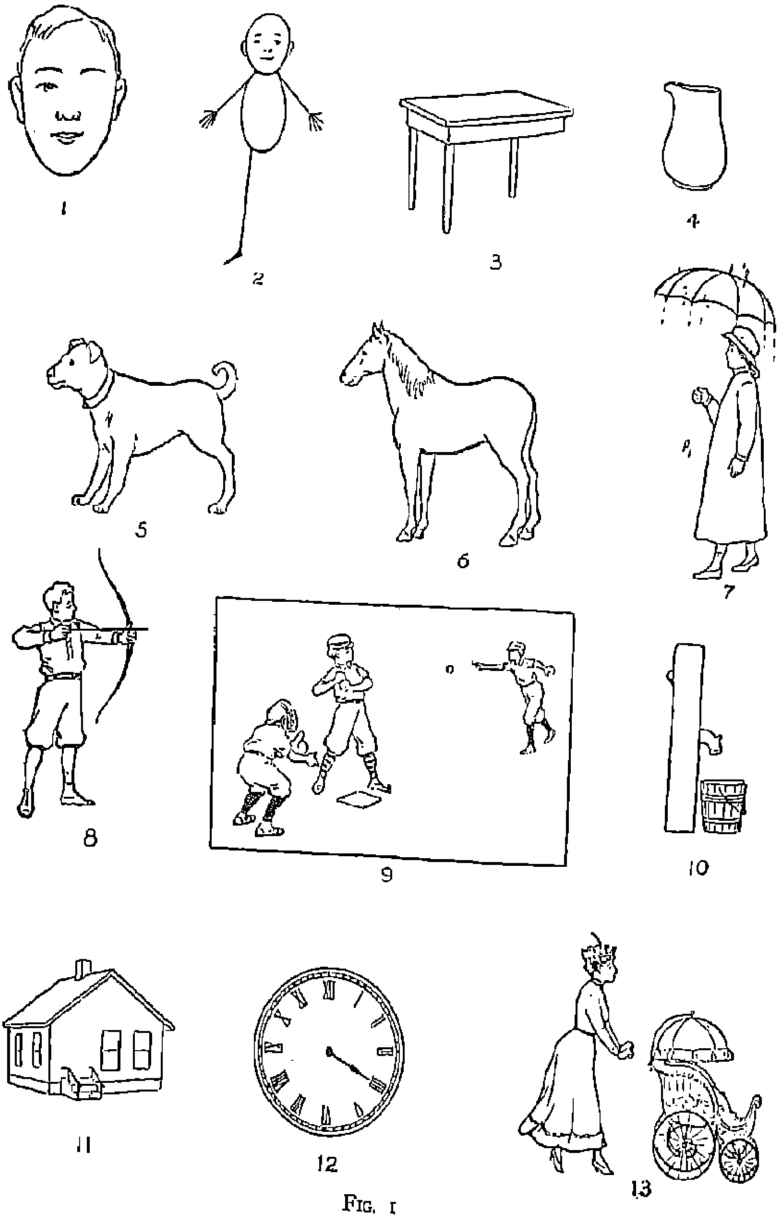
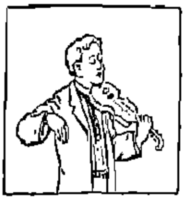


FIG. I



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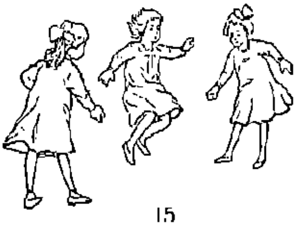

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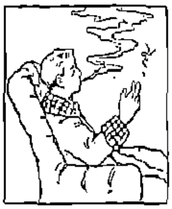

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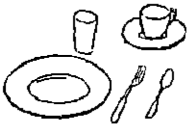

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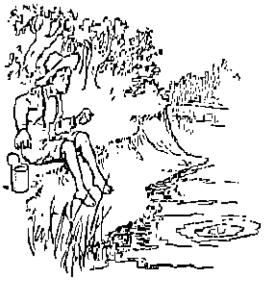

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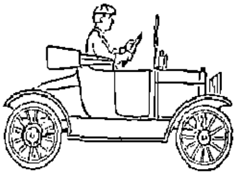

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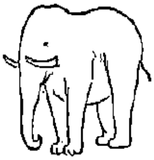

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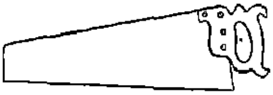

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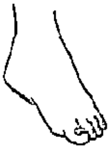

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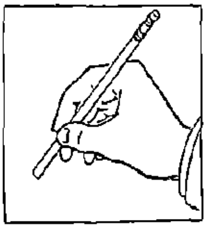

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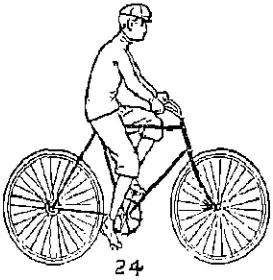

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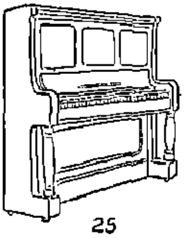

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TABLE I. PERCENTILE NORMS BY AGE.

Percentile	Age 5	6	7	8	9	10	11	12	13	14	15	16	Adult
100..........	44	68	69	70	74	74	74	75	75	75	75	75	75
90..........	43	56	63	67	71	72	73	74	73	73	73	74	74
80..........	28	52	59	64	69	70	72	72	73	72	72	73	72
70..........	25	46	57	62	67	68	69	70	71	71	71	72	71
60..........	23	41	54	61	65	67	68	69	70	70	70	71	70
50..........	18	38	52	59	64	65	67	68	69	68	69	69	69
40..........	16	34	50	55	63	63	65	67	68	67	67	69	68
30..........	16	32	47	52	61	62	64	65	66	65	66	67	67
20..........	6	24	43	48	57	59	61	62	63	63	65	67	66
10..........	2	17	36	42	52	55	57	60	60	58	62	66	63
0..........	0	0	0	2	25	31	36	48	45	39	36	62	60
No. of Cases.	15	107	124	142	184	160	136	103	113	143	82	28	60

hearing children. It will be seen that the median (the 50 percentile) increases rapidly from the lower to the higher ages. A distinct increase is present from age 5 to age 9, but from age 9 to age 12 the increase in score is only one or two points per age, and from age 12 upwards there is no increase in score. It would seem, therefore, that the test is discriminative from age 5 up to age 9 or, at most, age 12. This is also borne out by an inspection of the percentiles; from age 5 to age 9 there is a distinct increase in score between any two ages at any percentile; above age 9 the increase at any percentile is very slight and in some cases a decrease in score is noted. Obviously the test is too easy for children above age 10. It does not measure the differences in ability that probably really exist. In the last column of the table, the percentiles for 60 adults are given. Although these were University students, it will be noted that their scores are about the same as those of the 15 and 16-year-olds.

Table II gives the median scores for the deaf children as compared with the hearing children. The great difference in ability which is shown is to be expected, judging from the results of other tests of deaf children. The median for the deaf does not increase steadily from age to age. The 13 nine-year-olds are probably above the average ability of nine-year-old deaf children, because the median is higher than the medians of both the 10- and 11-year-olds. The thirteen- and fourteen-year-olds have the same median score; more cases should be tested at these ages in order to see whether

TABLE II. MEDIAN SCORES OF DEAF AND HEARING CHILDREN.

	Age 8	9	10	11	12	13	14	15	16
Deaf..............	19	40	33	38	48	51	51	59	62
Hearing..........	59	64	65	67	68	69	68	69	69
No. of Deaf.......	4	13	7	15	26	24	10	16	23

TABLE III. PERCENTAGE DISTRIBUTION OF CASES MAKING PERFECT SCORES ON EACH PICTURE, BY AGES.

Picture Number	Per Cent of Cases Making Perfect Score at Age of:—												Total	Order of Diff.
	5	6	7	8	9	10	11	12	13	14	15	16		
1	47	79	92	97	99	98	99	98	98	100	100	100	95.7	2
2	80	92	97	99	98	100	99	99	99	99	99	100	97.8	1
3	20	54	62	74	86	81	89	88	91	97	95	95	81.3	8
4	27	45	57	67	81	82	86	85	91	95	96	90	78.0	11
5	20	44	63	70	76	89	86	93	93	94	96	100	80.0	9
6	27	70	77	90	94	96	93	95	94	99	98	95	90.0	4.5
7	13	58	68	74	80	82	85	93	96	98	98	100	82.0	7
8	0	3	8	9	13	18	17	31	27	33	28	50	18.3	25
9	0	12	28	37	55	66	68	63	77	66	67	60	53.6	19
10	33	67	80	87	95	96	93	97	97	95	98	100	90.0	4.5
11	20	36	53	55	72	78	79	78	88	89	91	100	71.5	16
12	0	24	39	55	59	48	52	53	61	59	65	70	51.4	20
13	33	76	88	93	95	93	96	96	91	92	94	100	91.2	3
14	7	7	9	30	52	58	57	68	73	77	71	85	50.1	22
15	0	41	62	66	77	82	86	80	82	91	93	90	75.6	13
16	27	35	56	63	81	83	79	86	93	93	95	100	76.4	12
17	0	24	42	66	83	81	87	94	88	90	91	85	74.4	14
18	0	16	32	55	64	61	62	72	69	71	69	80	57.5	17
19	0	31	51	58	74	79	82	89	88	92	95	100	73.4	15
20	0	7	10	14	41	46	56	54	61	62	67	50	40.7	23
21	7	40	70	76	88	93	90	92	92	91	90	95	82.2	6
22	7	10	29	43	56	65	66	70	72	81	84	85	57.2	18
23	27	25	60	69	85	86	90	96	88	93	96	100	79.1	10
24	0	1	9	16	30	43	47	53	57	51	59	80	36.0	24
25	20	21	34	39	48	61	59	73	72	63	75	65	53.4	21
No. of Cases	15	106	131	153	193	165	140	120	127	142	82	20	——	——

13- and 14-year-old ability on this test is the same or not. It would appear that the test may be discriminative for deaf children up to age 15 or 16.

Difficulty of the Pictures

A study of the number of children who are able to insert the missing part in each picture will give us a rough order of difficulty for the twenty-five pictures. In this tabulation we have only taken into account the number of children making a perfect score on each picture, that is, a score of three. No attention was paid to scores of two or one, and therefore our order of difficulty will not be accurate when partial scores are taken into account; it is, however, accurate enough for our purposes. Table III gives the percentage of children at each age making a perfect score on each picture. The next to the last column of the table gives the percentages for all ages combined; and the last column, the rank in order of difficulty of the pictures as determined by these percentages. It will be noted that some pictures are passed by a large percentage at all ages; others by a small percentage at all ages and others by an increasing percentage from the lower to the higher ages. Picture No. 8 is only passed by 18% of the total cases; this is the picture of the boy with the bow. A correct response to this calls for a line from the ends of the bow back to the hand; this is the only response that receives full credit. The vast majority of children drew a straight line from one end of the bow to the other end, which response only received a score of two.

The percentage of children passing each picture gives us an order of difficulty for the twenty-five pictures at each age. A correlation of the order of difficulty at each age with the order of difficulty for all the children combined will answer the question as to whether the order of difficulty at each age is roughly the same. The rank of each picture at each age as determined by the percentage making a full score was therefore calculated, and the ranking at each age correlated with order of difficulty for all cases combined with the exception of ages 5 and 16 which were omitted because of the small number of cases at these two ages. The correlations calculated according to the formula,

$$\rho = 1 - \frac{6\Sigma D^2}{n(n^2-1)}$$, and converted into r values are:

Age	6	7	8	9	10	11	12	13	14	15
r	.96	.98	.99	.96	.96	.96	.93	.94	.93	.90

These correlations are all so high as to justify the use of the *rank obtained by the total number of cases* for an arrangement of the pictures in order of difficulty.

A Short Test

An inspection of Table III shows that there are many pictures passed by about the same percentage of cases, which means that some pictures have the same degree of difficulty. Pictures of the same degree of difficulty serve merely to lengthen the test and do not give any added information as to the ability of the individuals tested. It would seem desirable, therefore, to throw away a certain number of pictures and make a shorter test. We have constructed a short test of ten pictures which we are planning to use as one of a series of group tests.

Using the percentages in the "Total" column of Table III as our guide, we have chosen the following ten pictures for the short test:

Picture Number	Subject	Per Cent of Total Making Perfect Scores
2	Man	97
10	Pump	90
7	Umbrella	82
16	Smoker	76
11	House	71
22	Foot	57
14	Violin	50
20	Elephant	40
24	Bicycle	36
8	Bow and Arrow	18

The total percentage of individuals passing these pictures decreases gradually from the first to the last indicating that the pictures all differ in difficulty.

These ten pictures, therefore, constitute our shorter Drawing Completion Test. Before re-scoring the papers to obtain norms for this shorter test, a simplification in the method of scoring was adopted. It was felt that a score of three points for each picture allowed the subjective judgment of the scorer too much scope. The new method of scoring allows scores of 2, 1 or 0 and is as follows:—

Drawing Completion Test; New Method of Scoring

A score of 2 for the correct thing in the correct place, with no attention paid to beauty of drawing.

A score of 1 if the correct thing is inserted but not in the right place.

A score of 0 if the missing part has not been perceived, even although some other non-essential but appropriate part is added.

The emphasis is upon the *perception of the essential missing part;* thus, in Picture No. 24, a line for a chain is considered fully as good as any elaborate drawing of links of the chain. A difference of opinion is only likely to arise with regard to the scores of 1 point. The following samples of what was allowed a score of 1 may serve as a guide:—

Picture Number.

2. Leg very much out of proportion. Leg unduly curved.
7. Handle visible through umbrella. Handle going to wrong place. Handle not grasped or unduly bent.
8. String of bow straight, not quite at ends, curved back, outside the bow, curved like the bow, or half of string only.
10. Handle not at proper place.
11. Door in wrong place.
14. Bow at tip of fingers and not grasped. Bow upright or down.
16. Pipe or cigar in mouth, balanced on finger tips, extending from mouth to hands.
20. Two ears.
22. Toe added at the wrong side.
24. Line for chain not going over sprocket wheel, one line only for half of chain, line from sprocket wheel to front wheel.

It is to be emphasized that no credit was given for the addition of other things to a picture, even although they might be very appropriate, unless the subject added also the essential part that is missing, the credit being given for supplying the essential part.

The total possible score for the ten pictures is 20. The median scores for each age are as follows:—

Age..........	5	6	7	8	9	10	11	12	13	14	15	16
Median Score	5	9	12	13	15	16	17	17	17	17	17.5	18

As in the original test we note again the failure of the test to discriminate between the abilities of the older children as was to be expected from the percentages passing at each age.

The correlation between the long and short test will, of course, be high in spite of the slight difference in methods of scoring. We have not considered it necessary to calculate correlations for each age, contenting ourselves with choosing two ages, one fairly low and one fairly high. At age 6 with 107 cases, the correlation between the long and the short tests is .96, and at age 11 with 140 cases, .81. The coefficients for the other ages would undoubtedly be near these values.

The rank in order of difficulty for the ten pictures according to the new method of scoring differs somewhat from the rough ranking obtained under the old method when only maximum scores were considered. We have calculated for each picture the total number of credits made by all the children tested at each age, taking into account both full and half-credits. This gives us a rank in order of difficulty for each picture at each age. These total scores and ranks for each age are too lengthy to give here. Taking the average of the rankings for each age (omitting ages 5 and 16) we have a new ranking for the ten pictures which can be compared with the rough ranking previously obtained.

Picture No.	2	10	7	11	14	16	22	8	20	24
Av. Rank . .	1.0	2.7	3.0	3.5	4.9	5.7	7.2	8.4	8.7	9.7
New Rank. .	1	2	3	4	5	6	7	8	9	10
Old Rank. . .	1	2	3	5	7	4	6	10	8	9

The pictures of the shorter test should be arranged roughly in the new order of difficulty. Two or three minutes is suggested as a time limit; the new test contains only two-fifths as many tests as formerly. That time should be taken such that all but the most backward subjects will have time to attempt all ten pictures.

Conclusions

The Drawing Completion Test has proved useful and suitable for group testing purposes. It appeals strongly to all subjects. The kind of activity demanded is the same sort of thing as required by language completion tests and, since these latter have been found to correlate highly with tests of general intelligence, it may be presumed that the Drawing Completion Test will show a fair correlation. Because the use of the English language is not required in order to present the test or to take the test, it should be particularly useful in the testing of foreign subjects, deaf subjects and individuals whose language environment has been very much restricted. It would seem that the modified shorter form of the test is just as adequate as the original longer form. The shorter form would certainly be more desirable as one of a group of tests. The discriminative value of the test would seem to extend up to age eleven or twelve.

COMMUNICATIONS REGARDING "A PLAN FOR THE TECHNICAL TRAINING OF CONSULTING PSYCHOLOGISTS"

In the preceding issue of this JOURNAL[1] we submitted a tentative plan for the uniform training of consulting psychologists in the hope that it would arouse a widespread discussion and ultimately lead to some definite results. Up to the present writing a number of communications have been received in response to this appeal, from which we quote either in full or in part. The same topic is also treated more extensively in an article by R. M. Ogden in the present issue (pp. 179 ff.), describing "The Training Course for Psychological Examiners at Cornell University." In this connection we should also call attention to a Note on the American Association of Clinical Psychologists, by its Secretary Pro Tem., Mrs. Leta S. Hollingworth, in the present issue of this JOURNAL, p. 194, in which the urgency of the problems of training consulting psychologists is forcibly demonstrated. It is hoped that the generous response received thus far will stimulate others to continue the discussion in subsequent issues, so that we may arrive at a fairly representative view of psychologists regarding the problems involved, upon which to base a definite plan of action.

Professor Hollingworth of Barnard College writes:

"There are so many things to do these days that I have not been able to get at the discussion of your plan for training applied psychologists earlier. I cannot discuss it even now as fully as I should like, but the following comments may serve the immediate purpose.

"In the final chapter of APPLIED PSYCHOLOGY I have indicated that of the various ways in which institutional adjustment is to be made for more effective use of psychological attitude, content, and technique, the value of the adjustment will vary with its purpose. The most essential thing needed now seems to be the safeguarding of applied psychology. For this purpose it seems wise that effort be made to give the work of the applied psychologist, in whatever field, a dignified and professional status. Consequently, in place of beginning the standardization down in the freshman college year, it would seem to me more useful to begin with those doing graduate work. At present the fact that one has a Ph.D. in psychology in no way testifies to his ability as a clinical, educational, industrial or vocational psychologist. There are plenty of Ph.D.'s in psychology who have never seen a feeble-minded child at close range, never used an educational scale, never made a motion-study and do not know the meaning of 'labor turn over.' Why not begin by indicating, by means of some special diploma or certificate the special field of application in which the candidate may have knowledge. Instead of a blanket term, such as 'consulting psychologist,' I should, at present, favor some more specific set of titles, such as 'diploma in clinical psychology,' etc., no diplomas being conferred lower than the Ph.D. degree. To label the college graduate and the average M.A. candidate with the title 'psychologist' would for the present defeat the very purpose of the movement,—it would simply flood the market with people looking for jobs, and who would in no way contribute to the technical status of psychology. As time goes on it might be possible to confer the diploma of 'assistant,'—as 'assistant in clinical psychology,' etc., on M.A. candidates,—or it might do no harm to do that from the beginning.

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[1] L. R. Geissler, A Plan for the Technical Training of Consulting Psychologists. *Journal of Applied Psychology*, vol. 2, 1918, pp. 77-83.

"All of the preceding is on the assumption that for a great many years the status of the applied psychologist is to be similar to that of the chemist, pathologist, etc., in the modern factory and hospital,—the status of an expert in his own field. And before he can attain to this status he should already be an expert. But I take it that the time will come when instead of this arrangement the psychologist may develop into the psychotechnician, a sort of human engineer who is not necessarily limited in his work to the problems of one industry, hospital, or institution. When this time is reached some such special plan for training as you outline will be much needed, and I see no reason why the university departments should not be so organized as to provide this technical training, even though their main work must continue to be scientific rather than technical. Chemistry departments have been effectually organized so as to train the chemical engineer as well as the research chemist and the philosophical chemist. But I think that a broader and longer training is needed by the technical psychologist than by the technical chemist, so that although it may be appropriate to graduate the senior from college or engineering school with the title of 'chemist,' I should not favor similarly designating other seniors as 'psychologists.'

Your own plan for the course of study to be undertaken by the prospective technical psychologist seems to be well calculated to prepare the student for genuine technical and professional work in his graduate years. But I should not favor the granting of special diplomas until the work of those years has been completed.

"I am very glad that you are bringing the matter up for discussion in the JOURNAL OF APPLIED PSYCHOLOGY, and I hope that you find the interest sufficient to conduct a prolonged symposium from all the various points of view. The Association of Clinical Psychologists, which was originated at Christmas is at work on this problem in their own field, in which the matter is at present very urgent, and I hope that some of their active members may contribute to the symposium. My own ideas on the matter are at present rather tentatively expressed, and the symposium instigated by your own well conceived plan should do much to clarify them."

Dr. E. I. Keller, Consulting Psychologist, New York, writes:

"I have read your article on 'Training for Consulting Psychologists' with intense interest. The time is indeed ripe to prepare students for the work that is opening up for them in this department. As you suggest, the college courses should be chosen with care by those intending to elect such a profession. Off-hand I have two suggestions to make, first, as it takes a certain type, generally a mature mind, to wish to follow such a course, I think that most of the professional training as such should be taken *after* the B.A. degree is taken. Secondly, as a consulting psychologist needs much experience with individuals in the clinics, laboratories, or in business, the last degree should be preceded by years of experience in clinics in co-operation with pediatrists and neurologists, in business in co-operation with heads of employment bureaus, etc., and in analyzing the various occupations so as to choose aright the standardized tests for examinations of employees."

In a subsequent letter Miss Keller asks to add a third requisite. She wishes to "stress biology and anthropology, so as to force in consulting psychologists a genetic or biological point of view. This added to the mathematical training will help broaden and deepen their vision, and save them from being too exact and mathematical when the higher processes are to be considered."

Professor Scott, at present chairman of the Committee on Classification of Personnel in the Army, writes:

"The program which you have outlined is certainly most excellent. The only suggestion I would make is that there might be some possibility of getting in more practice work to give life to the theoretical work; for instance, if the instructor is giving a course on psychology of advertising, he should attempt to serve as counsellor for one or more firms, and bring before the class from day to day the problems that actually arise in connection with that work. If the course were connected with mental hygiene the same practice should be employed. This kind of work should not be postponed to the days of strenuous work, but should come in from the very beginning."

Dr. A. H. Sutherland, School Psychologist of Los Angeles, writes in a preliminary way and promises a companion article for a later issue. He says in part:

"I like your article recommending a training course leading to three different degrees in Applied Psychology. I believe that there will be some difference of opinion regarding the items in the course, and the titles which you suggest seem to me to be too much alike, and perhaps of too fine a distinction to be practical. . . . Have you considered modeling the training after that of the certified public accountant? You of course have not overlooked the fact that in order to prevent others from using the name Applied Psychologist, it would be necessary to have legislation in each state, and a license issued."

Professor Strong of George Peabody College for Teachers and at present a member of the Committee on Classification of Personnel in the Army writes:

"I have just found time to read over your Plan for the Technical Training of Consulting Psychologists. I think it is very desirable to publish such an article at this time, but I am not at all sure that I agree with some of the details in the article. For example, the specific courses which you outline for the undergraduate to take are not altogether to my liking. I would much rather have them take considerable biology than some of the other things you mention.

"I think it is almost hopeless to talk about 'assistant consulting psychologists,' meaning thereby a man who has received his bachelor's degree. I do not believe I have ever seen a graduate of a college who knew enough of psychology to give any great practical value to any one. Why not deliberately say the assistant consulting psychologist shall be one who has had a five years' course? This would be in line with the best practices in the engineering colleges of the country and would be more nearly in line with the procedure in medical and law schools. With a five year course we could supply the men with such training as would enable them to accomplish something worth while."

Professor Thorndike of Columbia University writes:

"I regret that the press of other duties prevents me from giving adequate consideration to the proposals concerning formal recognition of applied psychology or mental engineering, the provision of suitable degrees or diplomas, and arrangements for providing industry, business, social work and education with reliable experts and assistants for this work.

"In general I have much interest in improving university preparation for this work but relatively little interest in erecting formal distinctions between the charlatan and the scientific worker. That matter will, it is to be expected, largely take care of itself if an adequate supply of men and women competent at human engineering is available. The two main problems seem to be to enlist the interest of competent young men and women in this work and to decide how much of their university training shall be given to applied psychology itself and how much to the general understanding of business or industry or medicine or social work.

"I will not try to discuss the detailed program of the article except to note that our divisions between the Bachelor's degree, Master's degree and Doctor's degree seem peculiarly unfortunate in this case. About two years work in advance of the Bachelor's degree by a competent person who nevertheless lacks the high degree of scholarly and research abilities required for the Doctor's degree would seem to be about what should be expected for the standard diploma as psychologist. Engineering schools also very much need some degree to recognize two years work in advance of an ordinary engineering education. It seems, therefore, questionable whether we should submit to the traditional arrangement in this case."

THE TRAINING COURSE FOR PSYCHOLOGICAL EXAMINERS AT CORNELL UNIVERSITY

By R. M. Ogden

A year ago few psychologists would have been sanguine enough to predict that their active participation in the service of war would be apt to meet with the welcome and approval of military commanders. Under ordinary conditions, human inertia is too difficult to be overcome in a brief space of time. At a meeting of psychologists, held at Cambridge in April of last year, the question of applying psychological methods to problems of war was enthusiastically discussed, and tentative plans were formulated for carrying on such co-operative work as might be acceptable to the Government. Yet real as were the problems in the psychological field, and keen as were the psychologists to be doing their bit of service in their own professional realm, it was freely recognized that psychological technology was still in its infancy, and that among those who had devoted many years to psychology as a science, a conservative skepticism prevented a ready acceptance of all that the programs laid down by the applied psychologist seemed to embrace. Conservative psychologists were loath to enter the field of vocational guidance and individual analysis which many charlatans and 'character experts' had already more or less preempted, and preferred to bide their time until the foundations and methods of applied psychology had been more carefully tried out and perfected.

Then came the war, and with it the urgent need of grading and classifying thousands of men gathered from all parts of the country, and from all walks of life. Obviously, the job must be done, and better by far that it should be undertaken by men trained in the principles of scientific psychology, than by those who trusted only to intuition and haphazard guessing.

As is well known, the efforts of the psychologists who entered this service, and planned its methods and procedures, have been crowned with a large measure of success. Without undertaking to accomplish more than the present status of a scientific examination of mind by the approved tests of intelligence would warrant, they have demonstrated the value of these methods, and the economy of such means in the selection and classification of recruits to the National Service. Realizing that a successful fruition to the plans of the Psychology Committee of the National Research Council would mean a heavy draft upon the body of trained psychologists competent to undertake this work in the field, and that there would be urgent need of newly trained men, both to supplement in the field and in the laboratories at home, the Departments of Psychology and Education at Cornell University co-operated in providing an intensive training course for prospective psychological examiners.

With the approval of the chairman of the National Psychology Committee, this course was planned to emphasize the broad principles of experimental psychology and to afford training in the theory and practice of mental testing. The courses that constitute the frame-work of this training are courses which have long been standardized in the two Departments in which they fall. The first is a three-hour course in Elementary Psychology that surveys the field and emphasizes the content of the subject and the general methodology of a scientific approach. This course has hitherto furnished the prerequisite for all advanced courses in both psychology and education. No student was admitted to the training course unless he had completed this course, or was registered for it. The second was a laboratory course in Experimental Psychology of three two-hour periods. The students perform a series of psychological experiments so planned as to give a general understanding of the problems and methods of investigation which a psychologist must have at his command. The third, a three-hour course in Educational Psychology, deals with the functional aspects of psychology; mental dispositions, traits of character, and general and special educability. Since the interests of applied psychology, and in particular the problems of sorting and classifying recruits, are all, broadly speaking, educational in their nature, this introductory course in the Department of Education was adapted to furnish an understanding of the constitutional equipment and the individual variations of human beings.

The culminating course of the schedule is the one in Mental Testing. Like the one in Experimental Psychology, this is a laboratory course, and is given in two periods of three hours each. In it the theory and practice of mental and physical measurements are studied, with special reference to the application of adult scales. The participants undertake both the administration of the tests and the valuation of results. The theory of correlations, and the mathematical and statistical methods of handling data are emphasized. Although our clinical facilities at Cornell are somewhat limited, ample opportunity is afforded for practice in testing both individuals and groups of persons. The members of the course devise applications of individual and group tests, and then administer them to individuals and to classes of students in other courses of the two departments.

The scheme, in brief, is to provide an opportunity for properly qualified students to undertake intensive study along the lines mentioned, by permitting them to pursue simultaneously a number of cognate courses which under ordinary cooditions must be taken seriatim. No student is allowed to register for Mental Testing who has not taken, or is not taking, the three other courses normally prerequisite to it. Students who have already completed their prerequisites are advised to enroll for advanced work in psychology and mental testing, and likewise for certain relevant courses, such as the mathematics of probabilities and statistics.

The results of the first term's work were very encouraging. Seven male students completed the course and were recommended for "induction" into the National Service. All were senior or junior students in the College of Arts and Sciences. Some were registered for the draft, while others were under age. One, who completed his university course and received his degree at the end of the first term, was immediately inducted into the service. Others have been informed that they will be called in subsequent contingents to the psychological training camp at Camp Greenleaf. Ten men are enrolled in the course this term, and there are others engaged in advanced work. The course will be repeated during the summer session of the university, and has been announced for continuance next year.

Although the demands of the psychological examining corps are limited to the numbers required at the various training camps, there are other needs of the National Service which psychologists will be called upon to supply. The chief of these is perhaps in the field of re-education for the crippled and mentally shocked soldiers who return from the front as wards of the Nation. In England, and in other countries, work of this sort has been undertaken on a large scale. In it medical men, psychologists and educators, especially vocational experts, are co-operating. The organization of such a service has been authorized and is under way in this country, and psychologists, both men and women, are being asked to fit themselves for this important task. Here, then, is another reason for encouraging properly qualified students to enter the profession of psychology.

The demands of the National Service, though important and pressing, are of course uncertain as regards extent and duration. But for other reasons it is felt that the encouragement of intensive work in the field of psychology is peculiarly desirable at this time. As previously mentioned, the draft of mature men, already trained in psychology, has been very heavy. In consequence, many of the laboratories throughout the country are so short-handed that they have been obliged to curtail their programs, and even temporarily to suspend advanced work. Steps must be taken to prevent serious consequences from such a slackening of effort. Not only must the training of psychologists go on to supply the needs of Government Service, but the needs of the laboratories must be satisfied in order that both training and research may be continuously fostered.

There is also a special aspect of our work which cannot be neglected. Psychologists are demanded more and more in the educational, commercial and industrial fields. The successful venture of the psychologist in the ranks of the army will add measurably to his prestige in the pursuits of peace. Legislatures are already busily enacting laws which necessitate the mental examination of school children and wards of the state, and which imply subsequent segregation and special training for the deficient and the delinquent. One state already requires that its psychological examiners shall be members of the American Psychological Association, as an evidence of fitness for their work. Yet the membership of this association scarcely numbered three hundred before the war. Likewise in business, industry and agriculture, vocational experts are in demand. In the institutions for the feeble-minded, the insane, the blind, the deaf and dumb and the criminal group, psychologists are increasingly employed to fill important posts. We cannot but anticipate a large growth in the number of men and women who will find a professional calling in this field. It would therefore be a great mistake to relax any effort in holding the university courses of psychology at the highest level of efficiency and thoroughness, despite the inroads made by the exigencies of the war. Requirements once made by institutional boards or by legislative enactment are not lightly to be set aside. If the body of trained psychologists is unable to furnish men and women adequately equipped for the work at hand, we shall find other persons of inferior training and with unscientific methods ready to undertake in the name of psychology a work for which they are in no wise properly fitted.

Therefore, in advocating and in planning an intensive training course of psychology as a temporary measure of expediency, we at Cornell have had in mind, not alone the Government service, but also a demand which bids fair to outlive the needs of war, and to bring to the psychologist an extra-academic status of great significance in the welfare of our common life.

In conducting this work we have emphasized from the start a thorough training in the purely scientific aspects of psychology. It has been our conviction that a sound technology can be reared only upon foundations that are theoretically assured. It is not enough that one should know the technique of administering tests and computing results. To be competent as an expert one must understand both the structure and the functional growth of mind, and be intelligently conversant with the broad principles of scientific observation. We have therefore insisted that no recommendation should be given to students who have not successfully pursued fundamental courses of psychology, both theoretical and experimental. It appears to us that a real danger lurks in the enthusiasm which may prompt applied psychologists to advocate a brief training in the administration of mental tests as being quite sufficient for most practical purposes.

It has been gratifying to learn that the experience of those in charge of the field work in the Army vindicates the position we have taken. In this connection I may perhaps be privileged to quote from a letter of Major M. E. Haggerty of the National Psychology Committee. ". . . I should say," he writes, "that the most desirable thing for universities to do at this time is to lay emphasis on the fundamental courses, so that we shall have coming on a generation of men and women grounded in the fundamental subjects of psychology. Among these I should of course list general, experimental, abnormal, social and educational psychology. A man who is thoroughly grounded in these fundamental subjects, who has learned to attack his problems scientifically, and who has had some direct contact in dealing with hospital or educational situations from the standpoint of psychology, will be very quickly trained in the specific uses of his knowledge which will be demanded in psychological service. A thoroughly trained experimentalist with a clinical point of view will acquire in a very short time the technique of giving tests, and this technique we can give him with much greater ease than we can give him the fundamental training." Major R. M. Yerkes has also expressed himself in a similar manner.

Indeed, the experience of the men who are directing the field service of psychologists seems to be that a theoretically trained mind is able to carry over into the technical work habits and points of view conducive to accuracy, circumspection and a general resourcefulness which are too often lacking in those whose training has been largely technological, and therefore superficial. To an instance of this sort my attention has been called recently by the conclusion reached by a faculty of engineering in regard to the work and attainments of their students. In planning their courses so as to provide the greatest amount of information and technical skill within the time allotted to them, they have found that while achieving a smoothly running course into which students fit themselves with an " efficiency " that rivals the automatic assemblage of parts in a Ford automobile factory, they have ultimately succeeded in stifling the initiative of their men. It is the opinion of these instructors of engineering that their Sophomore students, whose work has been chiefly in the " pure " sciences of mathematics, physics and chemistry, show more initiative in their work than do the Senior students who have progressed into the technical phases of the course. Eventually the student becomes a first-rate workman, capable in the use of tools and materials when explicit directions are given him. But he lacks resourcefulness in meeting new situations. He lacks self-reliance, for he has never been placed upon his own responsibility, nor has he found either leisure or encouragement to develop and exploit his own ideas.

In a field like engineering where materials and methods are so largely standardized, the result is not altogether bad. At least, such a school may be expected to turn out good workmen, well-informed and capable within the range of their special training. But at best the product is that of the trade school, which is not primarily concerned with the cultivation of scientific intelligence and leadership. How many individual talents may be blunted by such a process, it is difficult to say; but lacking the true spirit of research, such training cannot be of the sort that comports itself well with the idea of a university.

However desirable it might be to have a large number of mediocre though competent psychological technicians, who can " follow directions," the time has not yet come when we may regard any such training in the psychological field as adequate. Psychology is still an experimental science in all its departments. To make a proper use of its data, to avoid errors that may have wide-spreading evil effects, psychological work must remain in the hands of persons broadly and adequately trained in its fundamental principles.

But the implications of this distinction of pure and applied science are still more widely applicable. It would appear that we have here another argument favoring the intensive pursuit of science in the universities. To understand the principles of a science, to be able to think in terms of research, is to become an adaptable and a self-reliant type of person. Whatever one does later in life, it is such persons who make good citizens; for they have come to think things through, and to rely upon principles which they accept with conviction, rather than from compulsion, or because "the book so states." A scientifically trained citizenry is more reliable in time of stress than one that is only technically trained, despite the greater amount of special knowledge which the latter may possess. It is perhaps because we of the universities have not sufficiently realized this fact that we have been so prone to allow our traditions to lapse as we make way for all sorts of courses in technological training without seeing to it that adequate foundations have been laid. At any rate the indictment that we *train* men and women without *educating* them is not lightly to be set aside.

In the field of psychological technology we must be especially alive to the danger of erecting an imposing superstructure without first laying a secure foundation, for we should remember that we are applying our tests and measurements to human beings whose very careers are at stake. Unless we enter upon this task with open-mindedness, sound judgment and a resourceful methodology, we shall only make a mess of it. In attempting to meet the urgency of the extraordinary conditions thrust upon us by the war, we at Cornell feel the importance of advocating that in each and all its varied aspects, applied psychology should be closely tied to the fundamental principles of the science. So long as this is done we may confidently hope that the applications of psychology to the business of life will be held firmly in the grasp of those best fitted to make them.

BOOK REVIEWS

Darwin O. Lyon. *Memory and the Learning Process.* Warwick and York, 1917. p. 180.

The author has suggested in the preface of his book two dominant motives, first, to present the general experimental material upon memory with special reference to this specific topic: "The Relation of Quickness of Learning to Retentiveness;" secondly, to discuss the memory process from an educational point of view, trusting that the conclusions drawn from the experimental data may be of some practical use to the teacher.

The general scope of the work may be shown by the chapter headings: Chapter I, On the Forms of Mental Activity; Chapter II, The Subdivisions of Memory in General with Special Reference to Their Relations to the Learning Process; Chapter III, The Relation of Length of Material to Time Taken for Learning and the Optimum Distribution of Time; Chapter IV, The Relation of Quickness of Learning to Retentiveness; Chapter V, The Educational Value of Psychological Research with Special Reference to Economy in Learning and Mnemonic Systems. Chapters I and II are largely devoted to the definition in the broader sense of the various aspects of the memory problem. This is not a mere compilation of the results of the work of different authors but the material is carefully analyzed and evaluated by the author with the statement of problems yet to be solved. Chapters III and IV, in the opinion of the reviewer, are by far the most valuable part of the book. In the first of these two chapters the author makes his greatest contribution. He gives the results of his own experiments covering a period of ten years and indicates and explains the various methods used by a series of eleven charts found in a pocket on the inside cover of the book. About all the other available experimental work upon this topic is carefully examined and several inconsistencies pointed out. "The curve of forgetting which has developed from Ebbinghaus' experiments upon nonsense syllables has given us what is sometimes known as Ebbinghaus Law." The results of the experiment were based upon his work with 24 nonsense syllables and covered but three experiments. Those for 36 nonsense syllables were based on only two experiments. With Ebbinghaus there was a relative increase of repetitions with an increase in the number of syllables memorized, while with some of the more modern investigators, such as Meumann and V. A. C. Henmon, the results show that there is a relative decrease in the number of repetitions with an increase in the number of syllables (p. 52). "The 'Once Per Day Method' on the whole appeared the most economical, but because of certain notable exceptions and the great amount of individual differences, Dr. Lyon concludes that the problem in its final analysis be stated "not in what is the most economical method of learning but what is the most economical method for Mr. Smith or Mr. Brown and how can they find this method out."

The Educational Value of Psychological Research with Special Reference to Economy in Learning and Mnemonic Systems is the title of Chapter V. This contribution seems to add little to the value of the book. The author apparently believes that there is of necessity and always will be considerable difference between the problems and methods of work of the pure psychologist and of the applied psychologist. It may even seem that in a few cases he sets up difficulties as we sometimes set up straw-men for the mere pleasure of knocking them down. It is of interest in this respect to note that experimental psychology is performing at present its best services in the fields of business, education, medicine and other applied work. The book as a whole is a distinct contribution to experimental psychology and in addition furnishes one of the best compilations of the available material upon memory. JAMES M. O'GORMAN.

W. S. ATHEARN. *Religious Education and American Democracy.* Boston and Chicago: The Pilgrim Press, 1917, p. 394.

The author of this volume pleads for a democracy of religiously educated people. And "one thing is clear to those who are closely in touch with the present tendencies, and that is that the United States will have a system of moral training for her people before ten years" (p. 12), either in the form of ethics or in the form of religion proper, and the form will be determined by the "attitude of the church people of this country during the next ten years." To complete our educational system we must build "a system of church schools closely coordinated with the public schools" (p. 14), supported by the church and consisting of three parts: the school for all, the training school for teachers, and the supervision. "It is the task of the schools to make democracy safe for the world."

In the chapter on *Correlation of Church Schools and Public Schools* the author discusses the three general methods proposed for the teaching of religion: 1. Teaching religion in the public schools; 2. Establishing parochial schools; and 3. Coordinating the two kinds of schools into a unified educational system.

While the reading of passages from the Bible would not be seriously objected to in the public schools, many would maintain that that is not religious education, and to engage teachers to teach religion in the schools would be a serious undertaking. Secular education should be received in secular schools and religious education be taken care of otherwise.

"Two things are clear (1) that the church must teach religion and (2) that it must do it outside the public schools" (p. 19), and it must do it in such a way as "to preserve the unity of the educative process. Three methods have been proposed for achieving this result" (1) Church vacation schools. (2) Academic credit for religious instruction under church auspices. (3) Week day religious schools sharing the child's time with the public schools.

Church vacation schools began as early as 1866 in Boston and have now an association of 339 schools, 2,731 teachers, and 73,058 pupils, costing 79 cents per pupil for six weeks instruction (1915). The American Institute of Religious Education has also held several schools during the past years, as have also other denominational bodies, with apparent success.

The problem of academic credit for religious instruction has become a real one, since we are beginning to recognize that the public schools are not the only educational agencies in the community and since the public schools demand so much of the child's time and energy that there is not time for music, art, etc., outside the required curriculum.

Bloomington, Illinois, High School gives credit for work done in music outside the school (eight out of thirty-two required for graduation). And in "Webb City, Mo., two semester credits may be made outside of the school under private teachers" (p. 62).

Chairs for religious instruction have been privately maintained in connection with the State Universities of Iowa, Kansas, Missouri, Michigan, North Dakota, Illinois, at Creeley College, et al. And credit has been given in high schools for religious instruction given outside the school. In North Dakota the state actually conducts an examination of students in Biblical subjects, the work being done outside the schools; in Colorado the state establishes conditions and approves of the work of an outside examining board; in Virginia the above two plans are combined. In Birmingham, Ala., and in Oklahoma credit is given in the elementary grades for work done in church schools and Bible classes. The credit usually given varies from *one-half* to *one*. The weakness of the plans is that the credit and promotion are granted solely on examinations conducted mostly by a second person, not by the teacher, and marked by a third person.

The standardization of Biblical courses would go a long ways towards solving the problem, and it belongs rightly to the church college to make such a standardization; this the church college has failed to do.

"No education is complete which ignores the religious element." But as the public school does not furnish this, and as the Sunday session of the church school is not adequate for the purpose, the church must have a share of the week days for religious instruction. Two plans have been developing for the solving of this problem. 1 The Wenner plan, which provides that the schools close every Wednesday afternoon, leaving the children free for religious instruction, and 2. the Gary plan, which, on account of the freedom that it allows the child, gives him an opportunity for religious instruction. This instruction takes place mostly in a church, where a teacher may instruct various grades successively during the day. The Gary system has not been very favorably looked upon at Gary, imposed as it was from without, but it is introduced in several schools in New York City.

At Malden, Mass., a new system has been started, which looks at the problem from the point of view of the community; it is in successful operation.

In the chapter on *Unification* the author discusses the relative merit of several Sunday School organizations and comes to the conclusion that "there is unnecessary duplication and great economic waste. . . .Some agencies must leave the field to those that can do the work better; other agencies must be united into more effective cooperation."

In the colleges which do not teach religion the voluntary student associations have proved inadequate to the task of imparting religious education to the student. And "the only colleges that could legally give religion an adequate place in the curriculum have failed to do so." "The heart of a church college should be its departments of Biblical History and Religious Education."

In the graduate schools "very few courses are offered in religious education . . . I know of no graduate institution which is taking its department of religious education seriously." They "have been without prophetic vision."

The book is an excellent review of the present condition of religious education and of the attempts made to bring about a better state of affairs. The references to the literature of the subject are really remarkable.

KARL J. KARLSON.

HORACE SECHRIST. *An Introduction to Statistical Methods.* The MacMillan Company, New York, 1917, p. 482.

This is *A Textbook for College Students, A Manual for Statisticians and Business Executives,* as the sub-title reads, which is "non-mathematical," and in which "the illustrations, for the most part, are drawn from economic and business fields." Although "the methods discussed are of general application," the point of view from which they are discussed is frankly that of a student of economics, and in particular, of business organization and management. Any student of statistics, however, will find in the volume much useful information and advice on such topics of general interest as the limitations of the statistical method, common sources of error in statistical arguments, averages as "summarizing expressions," methods of presenting statistical results, etc.

"The order of treatment," which "is the same as that followed in the planning and analysis of a statistical problem," is indicated by the chapter headings: 1. The meaning and application of statistics and statistical methods, pp. 1-13; 2. Sources and collection of statistical data, pp. 14-58; 3. Units of measurements in statistical studies, pp. 59-77; 4. Purpose of a statistical study of wages, units of measurements, sources of data, schedule forms,—illustrations of methods, pp. 78-115; 5. Classification, tabular presentation, pp. 116-157; 6. Diagrammatic presentation, pp. 158-192; 7. Graphic presentation, pp. 193-233; 8. Averages as types, pp. 234-293; 9. The principle of index number making, pp. 294-331; 10. American price index numbers described and compared, pp. 332-376; 11. Description and summarization, dispersion and skewness, pp. 377-424; 12. Comparison, correlation. The material is thoroughly organized, and the development of the subject is kept constantly before the reader by the device of introducing each chapter with a brief statement showing the relation of the material in it to what has preceded, and by concluding each chapter with a summary of the contents. There are excellent indices of subjects and of proper names. Representative references to the general literature of the subject are given at the end of each chapter.

The order of treatment involves, in the earlier chapters, notably in chapter 2, the presumption of an appreciation of statistical problems which may be reasonable in the case of those who will use the book as a work of reference, but scarcely seems justifiable in the case of an undergraduate who is making his first formal approach to the subject. A lack of accuracy of statement which characterizes the book elsewhere, is especially in evidence in the strictly mathematical sections. For example, the discussion of "weights chosen at random" (pp. 242-246) leaves much to be desired, especially in the light of a statement in the summary on page 290. On page 384 we read "If the arithmetic mean is used, and signs are considered, the differences" (i.e., deviations) "are equal to zero," where aggregate or algebraic sum of the differences is clearly meant. As a whole the book is notable for the emphasis upon those preliminary steps in any statistical study which must precede a mathematical analysis of the data and the institution of any comparisons based thereon.

C. E. MELVILLE.

JOHN M. BREWER. *The Vocational-Guidance Movement, Its Problems and Possibilities.* The MacMillan Company, New York, 1918, p. 333.

This timely volume is the best summary of the history, problems, difficulties, and possibilities of the movement toward vocational guidance that has come to hand. At the same time it is critical and constructive and manifests a wide knowledge of the literature on the subject.

The author's standpoint may be gathered from the following statement in his Preface: "If the movement for vocational guidance has so far proved but one thing, it is that the indefinite education for the vague thing called 'complete living' or 'physical, mental, and moral development' must give way to a well-considered aiming at specific needs—needs such as those represented by the individual's right, duty, and desire to fulfill family relationships, to vote intelligently, to maintain a good standard of living, and to coöperate in all phases of endeavor for human good. These specialized trainings are by no means narrow; it is the indefinite education which has been narrow." He defines vocational guidance as "a systematic effort, based on knowledge of the occupations and on acquaintance with and study of the individual, to inform, advise, or coöperate with him in choosing, preparing for, entering upon, or making progress in his occupation" (p. 228), and he refutes those who limit it to mere efforts of placement, or to the time of leaving school, or to merely practical or merely idealistic aims, or to restricting a child's ambitions, or to prescribing vocations on the basis of psychological classifications of children into types. He distinguishes it from educational guidance on the one hand and from vocational education and vocational training on the other hand, and thus clarifies many issues that have been confused or misunderstood. The history of the movement in the United States is traced in detail from the earliest efforts by Frank Parsons until the present day; a few earlier efforts and work in other countries are treated perhaps too briefly.

A most suggestive chapter shows how educational guidance can be utilized to a much greater extent than is done now, by means of the regular school curriculum, and how club and other activities as well as continuation and prevocational courses can be made more helpful in this respect. The problems of vocational counseling by parents, teachers, professional counsellors, employment or placement bureaus and other agencies, their advantages and disadvantages, and the need of more coöperation between the school authorities and industrial and commercial associations, such as chambers of commerce or the like, are sharply delineated. Of special interest to psychologists is the author's discussion of "pseudo-guidance" in which he includes mainly the vocational efforts based on mental tests and psychological classifications of individuals and types of mind. He criticises the experimental work or claims of such investigators as Hollingworth, Lough, Puffer, Schneider, Scott, Woolley and others and holds that "the psychologist may help vocational counsel best by aiding in the improvement of the school examinations in the various subjects: the laboratory should be the schoolroom and the exercise the regular work of the class. And he may help civil service commissions and business establishments in devising standardized tests based on the actual work the employees will be called upon to do" (p. 161), and adds the following footnote: "Scott's 'Salesmanship Test' tests general cleverness, but has little relation to salesmanship. Seashore's tests for musical ability are profitable as showing what may be done in fields requiring a high order of specialized ability. The testing now going on in the army at public expense has yet to prove its value." The reviewer is inclined to agree with many of these criticisms in so far as they are a warning against overconfidence in mental tests, although the author seems to have misapprehended the spirit in which they are undertaken by the very people whom he cites, while his implicit assumption that any given aspect of mental life or human conduct cannot be measured in terms of any other aspect seems to be well supported by the logical concept of measurement.

The sixth chapter outlines the need for further investigations of such questions as "(1) Why do children leave school? (2) How do they obtain work? (3) What kind of work do they do? (4) What are the opportunities offered by their work? (5) What proposals have been made to remedy existing evils?" (p. 179). A brief chapter on the problems of employment is followed by a detailed and most suggestive presentation of "a program for vocational guidance," which occupies practically the last fourth of the book. It offers a list of 64 activities, divided into 9 groups, which should be opened to pupils between 12 to 16 years of age, including the regular course of study and adding among others such activities as janitor work, fire department, sanitation committee, gardening, care of animals, dairying, painting and finishing, jewelry, bookbinding, printing, etc. One notable addition among these activities is the proposed life-career class, which is designed to begin as early as the fifth grade and to "aid the child to survey his opportunities, to decide on his career, and to prepare for his vocation" (p. 266). The children should be taught early to utilize various sources of information, to gradually prepare a survey of the field of occupations, to visit and observe people at their work, to analyze certain vocations and to examine their own characteristics as measured by concrete requirements. This life-career class should continue also in the colleges. The chapter makes many other recommendations, especially for coöperation between the school and all such agencies as come in direct contact with the human aspects of industry, commerce, agriculture, legislation, and the like. The whole program is finally summarized into eleven main recommendations, and the most appropriate immediate steps for inaugurating it are briefly stated. A bibliography of sixteen pages and an appendix containing problems and questions for class discussions on each chapter make the book a valuable aid for purposes of self and class instruction. L. R. G.

RUDOLF PINTNER and MARGARET M. ANDERSON. *The Picture Completion Test.* Educational Psychology Monographs No. 20. Warwick and York, Inc., Baltimore, 1917, p. 101.

This monograph describes the method of standardizing Healy's Picture Completion Test (The Farm-yard) on the basis of results from over fifteen hundred subjects varying in age from 5 years to adulthood. Healy's instructions were used and "an exact record kept of every move made by the examinee" as well as of the time required for completing the test. Each person was tested individually under most favorable conditions. The method of scoring, however, differed entirely from Healy's, being based upon the actual frequency of each correct or incorrect move made by the subjects. Of the nine possible correct moves the one which was done by the fewest number and therefore considered the most difficult of all was given the highest score, namely 100 units, and the other correct moves received scores in inverse proportion to the percentage of recorded cases, the easiest being scored 52 units. The errors were rated proportionately lower, a score of 1 unit denoting that between 1.5 and 2.2 per cent. of the subjects made this incorrect move. All less frequent moves were disregarded, so that the final table represents only 61 out of 423 possible moves; and the highest or perfect score amounts to 646 units.

By comparing different age groups with each other and with the total group of subjects it was found that "the relative ease or difficulty of the moves is pretty much the same for any age-group," and "that no particular injustice is done to any age by the method of scoring adopted." Accordingly, the authors computed age-norms and percentile norms for each age which can be used for purposes of a year scale, a point scale, or a percentile scale. They also found that the test is of equal difficulty for both sexes and that children from a good or medium social environment score somewhat higher than children from a poor environment. Likewise the pupils who were accelerated in their school work obtained higher scores than the retarded pupils. As compared with other ways of scoring the new method enables one to make much finer differentiations and to obtain truer values. The time element seems to be of no diagnostic value, although the authors recommended that Healy's five-minute limit be extended to ten minutes. The more or less uniform increase in the median number of units scored from year to year makes the test appear of much significance and greatly enhances the value of the author's work in standardizing this important test. L. R. G.

The following books and pamphlets have been received:[1]

Maurice Parmelee. *Criminology.* The Macmillan Company, New York, 1918.

William A. White. *The Principles of Mental Hygiene.* The Macmillan Company, New York, 1917.

William Healy. *Mental Conflicts and Misconduct.* Little, Brown, and Company, Boston, 1917.

Augusta F. Bronner. *The Psychology of Special Abilities and Disabilities.* Little, Brown and Company, Boston, 1917.

Joseph Jastrow. *Character and Temperament.* D. Appleton and Company, New York, 1916.

Arthur James Todd. *Theories of Social Progress.* The Macmillan Company, New York, 1918.

Maximilian P. E. Groszmann. *The Exceptional Child.* Charles Scribner's Sons, New York, 1917.

John Edgar Coover. *Experiments in Psychical Research.* Leland Stanford Junior University' Publications, Psychical Research Monograph No. 1, Stanford University, California, 1917.

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[1] Mention here does not preclude further comment.

EDWARD SAFFORD JONES. *The Influence of Age and Experience on Correlations Concerned with Mental Tests.* Educational Psychology Monograph No. 22. Warwick and York, Baltimore, 1917.

LEWIS M. TERMAN, GRACE LYMAN, GEORGE ORDAHL, LOUISE ELLISON DAHL, NEVA GALBRETH, and WILFORD TALBERT. *The Stanford Revision and Extension of the Binet-Simon Scale for Measuring Intelligence.* Educational Psychology Monograph No. 18. Warwick and York, Baltimore, 1917.

JUNE E. DOWNEY and EDWIN B. PAYSON. *Unidextrality and Mirror-Reading.* Reprinted from *Journal of Experimental Psychology,* vol. 2, No. 6, 1917, pp. 393-415.

J. E. WALLACE WALLIN. *Feeblemindedness and Delinquency.* Reprinted from *Mental Hygiene,* vol. 1, 1917, pp. 585-590.

——. *The Phenomena of Scattering in the Binet-Simon Scale.* Reprinted from *Psych. Clinic,* vol. 11, No. 6, 1917, pp. 179-195.

——. *Wide Range versus Narrow Range Binet-Simon Testing.* Reprinted from *The Journal of Delinquency,* vol. 2, 1917, pp. 315-330.

The American Journal of School Hygiene, vol. 2, March, 1918.

The Journal of Educational Psychology, vol 9, Dec. 1917.

The Macmillan Company, *Notes for the Guidance of Authors,* 1918.

NOTES

The American Association of Clinical Psychologists was organized at Pittsburgh, on December 28, 1917. The membership includes men and women holding the doctorate in psychology, who are engaged in the clinical practice of psychology in the United States. The forty-five charter members are chiefly directors of clinics, of bureaus of child welfare, of institutional laboratories; in army service, as mental examiners of officers and recruits; or connected with courts, hospitals and schools.

The objects of the Association are to promote an *esprit de corps* among psychologists who have entered the practical field, to provide media for the communication of ideas, to aid in establishing definite standards of professional fitness for the practice of psychology, and to encourage research in problems relating to mental hygiene and corrective education.

DEPARTMENT OF PSYCHOLOGY IN THE LOS ANGELES PUBLIC SCHOOLS.

Los Angeles, long recognized as a leader in educational affairs, has taken another step in the direction of better education. Under the leadership of Dr. Albert Shiels, formerly Director of the Bureau of Reference and Research in New York City Schools, there has been created a Division of Psychology at Los Angeles to undertake an intensive and scientific study of the progress of types of children,—to be applied to the problems of over age, over-size pupils, the promotional system, the minimum essentials for school work, and provision of exceptional children both retarded and advanced. Dr. Arthur Howard Sutherland of Yale University was selected to organize this division and carry forward the researches in educational psychology.

Perhaps the most obvious type, from an administrative standpoint is the retarded child, and before any administrative action can be taken it is necessary to know about how many there are in the school system. Therefore a survey was undertaken in twenty-four elementary schools in which about 1200 pupils were tested individually by psychological tests including the Binet (Goddard 1911 Revision). With these records there were gathered also the health records, the school records, the attendance records, and some items regarding the playground and manual abilities. The results show that in ungraded rooms in Los Angeles, the percentage of children retarded mentally three years or more is 70.4%; that the percentage of mentally retarded three years or more among those children who were not promoted at the February examinations in 1917 is 34.6%; that in the Parental Schools the percentage is 81%. If the schools selected are in any way typical this would seem to indicate that there are in the school system in Los Angeles something over five thousand children whose mental age shows a retardation of three years or more.

The next step in the administrative problem is to determine the individuals, their location and their mental level. Since it is impossible for one psychologist to spread himself among 90,000 school children, it became necessary at once to consider to what extent teachers and principals can be used to contribute the necessary data. It was found that a considerable number of teachers have undertaken to attend special classes and are already using some of the tests of the laboratory. *Many of them have heretofore posed as psychological* experts, after a short course at some one of the prominent training centers. It was therefore considered advisable to announce that these psychological tests are on exactly the same basis with an examination in arithmetic, reading, spelling or other school activities, and everyone should use tests regardless of training. It is hoped by this means to establish the point that the tests are no better than the person who uses them, and that if used by the teacher for her own information in teaching; that is, to guide her to methods of presentation and quality work expected that they will be an invaluable aid to intelligent instruction. At the same time, the point is emphasized that these by themselves will show no more regarding feeble-mindedness than do tests in arithmetic, reading, etc.

Over one hundred teachers have enrolled in a special course in experimental psychology. In this course no tests are being taught. The course as outlined is a training course in laboratory psychology, designed to lead the student to make simple psychological analyses, and interpret her own observations in psychological terms.

At the same time the teachers are gathering together in small groups to learn to do the Binet Test and are sent out to test *normal children only*. It is also announced firmly and widely that the performance of the Binet does not constitute one a psychologist.

Meanwhile plans are going forward to teach the better class of teachers to make "case studies" which shall include five steps.

1st. Family History.

2nd. Economic and Social Environments.

3rd. Physical Measurements.

4th. Mental and Psychological Measurements which include school room tests both group and individual.

5th. The Principal's and Teacher's estimates from sloyd, playground, etc.

It is planned as soon as possible to carry out this organization and collect at a central office this fall data regarding each exceptional child.

Meanwhile ten special rooms have been established in which to carry on teaching experiments on backward children. It is possible to select special teachers who have had some psychological training, and a certain measure of success has attended the experinment. Some of the children diagnosed as feeble-minded have made progress in comprehension, others have not, and it is a question whether the expense necessary is warranted.

The case study method is expected to discover also the gifted children, children who are gifted in special subjects, also those retarded in special subjects, and those who show peculiar interests, abilities and dispositions.

The value of the Division of Psychology at Los Angeles has already been recognized in connection with the Juvenile Court, the Probation Department, the Civil Service Commission, and the Employment Agencies, to say nothing of music teachers, and special schools of the vicinity. It is expected that another year will show wide spread coöperation among many interests to educate parents, and teachers to a much higher standard of demand upon the schools.

Professor John Wallace Baird, Clark University, one of the editors of this *Journal*, has been appointed Vice-Chairman of the Psychology Committee of the National Research Council. His address is 1015 Sixteenth Street, N.W., Washington, D. C.

At its last annual meeting in Pittsburgh, December 1917, the American Psychological Association authorized the appointment of a permanent Committee on Publications in Applied Psychology. The following constitute this Committee: H. L. Hollingworth, James Burt Miner, Walter D. Scott, Edward K. Strong, Jr., and L. R. Geissler, the latter acting as Chairman.

For the duration of the war the Committee has decided to carry on its work in the following way: It will examine the publications in applied psychology or pretending to belong to this field and publish the titles of such works in the *Journal of Applied Psychology*, and perhaps in one other psychological periodical, over the initials C. P. A. P. Any of these works that may be reviewed by members of the Committee at some later time will be marked: "*pro tem.* C. P. A. P." Such reviews will also be published in the *Journal of Applied Psychology* over the same initials. Copies or at least complete titles of publications suggested for examination by the Committee may be sent to the chairman, Dr. L. R. Geissler, Clark University, Worcester, Mass.

Dr. Guy Montrose Whipple has resigned his position as Professor of Education at the University of Illinois to accept a position at the Carnegie Institute of Technology as Professor of Applied Psychology and Director of the Bureau of Educational Research. Pending the return to the Institute of Dr. Walter D. Scott, now serving at Washington as Chairman of the Committee on Classification of Personnel, the development of the new Bureau of Educational Research, which is aimed to investigate those pedagogical problems that arise in the work of the Institute and that offer hope of solution by experimental or statistical attack, will proceed slowly and Dr. Whipple will serve in Dr. Scott's stead as Acting Director of the Bureau of Salesmanship Research.

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MENTAL TESTS OF A GROUP OF EMPLOYED MEN SHOWING CORRELATIONS WITH ESTIMATES FURNISHED BY EMPLOYER

By JESSE KNOWLTON FLANDERS, Oakland, Cal.

This study is a unit of a larger problem in which the writer has interested himself. The object of the larger problem is to discover possible ways in which intelligence tests may be of service both to schoolmen and employers for the better placement in vocations of those who are to do the world's work. The Stanford-Binet Scale, which was used in the present investigation, is the outgrowth of several years of painstaking effort by a number of psychologists in an attempt to perfect a means by which to measure native intelligence. Many of us believe that this has been a wise expenditure of time and effort. Nevertheless a large amount of careful work remains to be done, both in the improvement of current intelligence scales and in the determination of their practical value. The worth of the Binet scale, and of similar scales, has already been demonstrated in the care of various types of defectives and delinquents. It has also been shown that the scale can be made of invaluable assistance to the school-administrator in the better grouping of pupils according to ability, particularly in discovering the exceptionally gifted and the exceptionally limited. When all due credit is given, however, to those who have done notable pioneer work along these and kindred lines, the fact remains that we are very much in the dark as to the extent to which, and the manner in which, intelligence tests may be of service in the solution of complex sociological problems which hinge, in part, upon the native abilities of various social and occupational groups. In the hope of establishing a wider field of service for intelligence testing, a series of studies was planned by the writer which would involve the testing of several groups of adults in various types of commercial and industrial lines, these groups to include individuals of every occupational status from those whose work is of non-skilled and routine character up to and including the professional classes. The main purpose throughout was to determine the degree of correlation between intelligence and success in the various vocations. It was hoped that the information to be gained would prove serviceable both for the vocational counselor in the school and for the employment manager in the industry.

The study here reported is only a beginning. It was made possible through the courtesy and co-operation of the superintendent of a large express company who provided a quiet room for the conducting of the tests and arranged to have his employees come there one at a time throughout the working day. Forty-seven were tested, most of whom were rated as clerks, although the group included a few drivers, collectors and loaders. The men were selected under the direction of the superintendent, the only restriction to his freedom of choice being that he should pick those concerning whom he would be able to give the desired additional information and that he should not pick anyone who had not been in the employ of the company for at least a year. This last restriction was violated in seven instances; three men had been with the company eleven months each, one for nine months, one for eight months, and two for six months each. By these restrictions, however, the large class of "floaters" was eliminated, as the median length of service was five years. It is believed that the group is fairly representative of that portion of the organization which was considered and of the men who may properly be regarded as permanent employees.

The seven following qualities were chosen for comparison:

Intelligence
Accuracy
Speed
Co-operativeness in execution of work
Loyalty to employer
Dependability
All-round efficiency

Each man was classified independently by three of his superiors in each of these qualities according as they regarded him as,—Very Superior, Superior, Average, Inferior, Very

Inferior. These estimates were afterwards transformed into a numerical value on a scale from 5 to 1 and the three estimates combined to derive a final score. This made a possible variation in score from 15 to 3 in each quality. As a matter of fact, the variation was only from 15 to 8, due to the reluctance of those estimating to classify any employee as either inferior or very inferior. This reluctance was probably justified in view of the fact that these employees had survived the weeding-out process which had eliminated many "unfit." It served, however, to reduce the spread in the estimates and doubtless rendered the correlations somewhat less reliable than they would have been if definite instructions had been given for all of the men to be arranged in rank-order regarding one particular quality, and this procedure repeated for each of the other qualities. Had this been done, there would have been a stronger incentive for those judging to compare each man very carefully with his associates and at the same time the offending terminology would have been avoided. The classification which was used has been repeatedly and successfully used with school children. The two situations, however, are quite different. A school teacher has no reluctance in confidentially classifying as very inferior a pupil for whose presence in her classroom she is in no way responsible, while an employer regards it as a reflection upon himself to admit that he has retained the services of one who could be so classified in any of these fundamentally desirable qualities. The information regarding the salary received by each man was furnished by the superintendent; the other information used in deriving the correlations of table No. 1 was obtained directly from the subject himself at the time of the testing.

The correlations were found by the Pearson formula. The occupational status of the father was determined by Taussig's classification. In computing the intelligence quotient the actual age above 16 years was disregarded. The range in actual age was from 55 to 19 with the median at 30.

Most of the correlations are low. Perhaps the two most interesting findings of this study are, that intelligence, as measured by the test and expressed in I.Q., shows such a slight correlation with salary, and that the correlations between it and dependability and loyalty, while small, are actually negative. It was thought that salary would be the best measure of all-round efficiency obtainable, and that efficiency would be largely determined by original endowment, chiefly by native intelligence. But it appears that there are factors more important than intelligence in the ultimate determination of

TABLE NO. 1

	I. Q.	School Grades Completed	Occupational Status of Father	Salary	Intelligence Rating	Accuracy	All-round Efficiency	Length of Service	Speed	Actual Age	Cooperativeness	Dependability	Loyalty
I. Q.	—	.44	.35	.13	.05	.03	—.02	—.04	—.05	—.12	—.15	—.21	—.22
School Grades Completed	.44	—	.37	.08	.03	—.04	—.11	—.10	.01	—.13	—.14	—.18	—.21
Occupational Status of Father	.35	.37	—	—.10	—.04	—.11	—.15	—.19	.06	—.15	—.18	—.29	—.29
Salary	.13	.08	—.10	—	.30	.51	.39	.47	.28	.37	.23	.28	.33
Intelligence Rating	.05	.03	—.04	.30	—	.63	.74	.18	.49	.09	.54	.63	.41
Accuracy	.03	—.04	—.11	.51	.63	—	.74	.20	.47	.20	.55	.74	.48
All-round Efficiency	—.02	—.11	—.15	.39	.74	.74	—	.15	.46	—.03	.67	.73	.56
Length of Service	—.04	—.10	—.19	.47	.18	.20	.15	—	.17	.71	.00	.18	.05
Speed	—.05	.01	.06	.28	.49	.47	.46	.17	—	.07	.38	.39	.42
Actual Age	—.12	—.13	—.15	.37	.09	.20	—.03	.71	—.07	—	.14	.22	.20
Cooperativeness	—.15	—.14	—.18	.23	.54	.55	.67	.00	.38	.14	—	.67	.75
Dependability	—.21	—.18	—.29	.28	.63	.74	.73	.18	.39	.22	.67	—	.56
Loyalty	—.22	—.21	—.29	.33	.41	.48	.56	.05	.42	.20	.75	.56	—

a man's worth to his employer; at least, the man with the highest intelligence may not be the most desirable. In fact, we are led to believe that the men at the upper end of the scale in this group could be replaced by others with less intelligence without any sacrifice of efficiency. The same expenditure of money would thus secure men who would be more loyal and more contented. It should be kept in mind that the correlation between intelligence quotient and salary is of very little importance since the probable error for 47 cases and a correlation of .13 is .096. The range in mental age was from 18 years and 7 months to 10 years, with a median at 15-2; the upper quartile was at 16-7 and the lower quartile at 13-9. (See table No. 2.) Evidently there is a great deal of intelligence going to waste, since the work that these men do is of a routine clerical nature calling for a high degree of accuracy but offering an exceedingly limited opportunity for the exercise of ingenuity or even personal judgment. Success is achieved by the faithful performance of an ordinary task for the doing of which perfectly definite rules have been given. The positions included are known by such names as Accounting Clerk, C. O. D. Clerk, Settlement Clerk, Waybill Clerk, Clerk in Value Room, Clerk in On Hand Department, Clerk in Over and Short Department, Suspense Clerk, Receiving Clerk, Wagon Despatcher, Chief Router. These names indicate a high degree of specialization. The men in the group constitute the rank and file of an organization of 700 employees, from which a small number of supervisors and semi-officials have been eliminated at one end and a large number of "floaters" at the other. They present the typical labor problems of this company.

Why should men with a mental capacity which would enable them to acquire a college education be found doing work exactly similar in character to that which men can do who would never be able to complete in a satisfactory manner the eighth grade of our elementary school? It may be that they are lacking in emotional, moral or other necessary qualities; it may be that economic pressure crowded them out of the schools before they were able to prepare for more exacting service; it may be that the schools did not provide them with proper training; it may be that they selected their vocation blindly and ignorantly. Whatever the reason, there is evidently a big social and economic loss. We have been told that there was no place in our present civilization for the man with eleven or twelve year intelligence. If the findings of this study are verified and are found to hold generally in

TABLE No. 2

Distribution of Group by Mental Age

Mental Age	Number	Mental Age	Number
9–7 to 10–6	1	14–7 to 15–6	11
10–7 " 11–6	3	15–7 " 16–6	8
11–7 " 12–6	0	16–7 " 17–6	6
12–7 " 13–6	3	17–7 " 18–6	5
13–7 " 14–6	9	18–7 " 19–6	1

other industrial lines, we shall need to concern ourselves more with the problem of providing a larger number of jobs suitable for those who can score sixteen or seventeen years on the Stanford Revision, and with the further problem of making available the proper training for such jobs. We know there is a tendency in modern industry to develop what the men cynically call "brainless systems," where one mind frequently directs from 10 to 20 others with such minuteness that the other men closely approximate the moving part of a machine. In such a system the man with limited capacity has come into his own; he can render service to society where the more intelligent man would fail. It is conceivable that we may discover that one of the chief causes of the widespread labor unrest is due to workmen who chafe under a monotonous type of work because their active minds are not sufficiently occupied. We need to know the facts.

Salary correlates most highly with accuracy and next with length of service. If a man does reasonably satisfactory work and remains with the company his salary is increased. One would like to have full information regarding those who have left the employ of the company over a period of years; both those who failed to make good and those who found the service irksome. Those who remained cannot be regarded as peculiarly adapted for just this kind of work since only three expressed unqualified satisfaction with their present position. These three had a mental age below the median for the group. Furthermore, there is no correlation between loyalty and length of service.

We have been taught that additional schooling increases a man's earning capacity; and on the whole that is doubtless true. We have here, however, a concrete case where schooling seems to be of no importance whatever. The range in number of grades completed is from 13 to 3, with the median at 8. One man had finished a year at Annapolis; he was the only one who had gone beyond the high school. There were three others who had completed a high school course. Twenty-three of the group had at some time undertaken a course of study to supplement their public school training, such as commercial school, correspondence school or evening school. Of these, 12 were above and 11 below the median in mental age; 3 were receiving the median salary, 10 were getting more and 10 were getting less. At the time of the interview there were only four who, in their leisure time, were pursuing a purposeful or systematic course of study in an effort to prepare themselves for a higher type of service.

Three men had a definite ambition to reach a particular position within the organization; 9 had the laudable but indefinite desire to "rise in the ranks;" 18 had ambitions the realization of which would have taken them outside of the organization; 17 would express no definite ambition of any sort and yet only three of them were satisfied. It is so much easier to know that we are dissatisfied with what we have than it is to know exactly what we want. As already stated, only four men were using their leisure time to help achieve their ambition. The most notable case is that of a man who wishes to become a Christian Science practitioner. The seriousness of his purpose is evidenced by the fact that, in order to prepare himself, he has been studying four hours a day for three years. He has a mental age which places him in the upper one-fourth of the group. As he never got beyond the first year in high school it is probable that he has a very meagre equipment of scientific knowledge. A similar case discovered by the writer in another study has caused him to wonder to what extent this condition, of high mental endowment and limited education, accounts for the growth of various pseudo-sciences. Is it not natural for the alert, active mind to demand some sort of problem to grapple with? Certainly we have no right to expect that the conclusions reached by

TABLE No. 3

Intercorrelations of the Seven Qualities as Estimated by Superiors

	All-round efficiency	Dependability	Accuracy	Cooperativeness	Intelligence Rating	Loyalty	Speed
All-round efficiency	—	.73	.74	.67	.74	.56	.46
Dependability	.73	—	.74	.67	.63	.56	.39
Accuracy	.74	.74	—	.55	.63	.48	.47
Cooperativeness	.67	.67	.55	—	.54	.75	.38
Intelligence Rating	.74	.63	.63	.54	—	.41	.49
Loyalty	.56	.56	.48	.75	.41	—	.42
Speed	.46	.39	.47	.38	.49	.42	—

such minds shall always be sane and safe when the thinking has been done in entire ignorance of even the fundamental facts of the physical and biological sciences. This again emphasizes the fact that as a matter not only of conservation, but of self-defense as well, society cannot afford to continue to allow the highly gifted child to become submerged. We must discover him when he first enters school and see to it that regardless of the economic resources of his parents he is given a thorough education.

Table No. 3 shows the correlations between the different qualities as estimated by the judges. It will be noted that these are all high. There is a strong tendency for these qualities to be found together. Speed shows the lowest correlations. It never exceeds .50, while each of the others correlates as high as .74 with at least one of the other qualities.

The correlations between the estimates of one judge and those of another are given in table No. 4. On the whole they are fairly high, but since it is necessary, for the purpose of computing these, to divide the group into two smaller groups, because the same judges did not estimate all of the men, the P.E. is so large that care must be exercised in drawing conclusions from them. The closest agreement appears in speed and the least in loyalty. B and C have a very high correlation in their estimates of loyalty while each of them has a negative correlation with the estimates of A, which makes it evident that their standard was very different from his. If we combine their ratings and also those of D and F of the other group and then correlate the score thus obtained with I.Q., the result is a correlation of —.39 instead of —.22 which had previously been obtained. The correlation between the estimates of A and the I.Q.'s for the small group is only .10 which is of no significance since it is less than the P.E.

TABLE NO. 4

INTERCORRELATION IN THE ESTIMATES OF THE JUDGES FOR 19 OF THE MEN

	Speed	Accuracy	All-round efficiency	Intelligence Rating	Dependability	Cooperativeness	Loyalty
A & B...	.80	.42	.33	.18	.51	—.28	—.22
A & C...	.62	.52	.27	.58	.00	.28	—.36
B & C...	.50	.75	.31	.00	—.20	—.17	.71

INTERCORRELATION IN THE ESTIMATES OF THE JUDGES FOR 28 OF THE MEN

D & E...	.67	.57	.40	.55	.15	.52	.33
D & F...	.52	.47	.29	.70	.16	.41	.50
E & F...	.46	.38	.38	.21	.39	.49	.13

Before beginning the test the writer talked from five to ten minutes with each man, gaining his confidence, putting him at his ease and getting the information concerning parentage, schooling, etc., which was used in making the correlations. In a number of cases an estimate was made during this talk of the man's mental age. While most of these estimates were reasonably accurate, they were, in two instances, so wide of the mark as to confirm the writer in his conviction that he would make a poor disciple of Dr. Katherine Blackford!

Subject No. 47 is 24 years old and of Portugese parentage. He has a pleasing manner and good address and was estimated as having a mental age of 15. He reached the eighth grade after ten years of study but did not finish it. He was 16 when he left. He began work with the express company as a wagon driver. In the eight years he has been with them he has held a dozen different positions and made a good record in every one. He is now Receiving Clerk at the company's main depot. Packages are delivered to him for shipment to every part of the United States. He looks up the rate, proper routing, train connections, time required in transit, rules for crating, etc., whenever these are required by the shipper. He is exceedingly scrupulous about following directions and will never vary from them upon his own initiative. He is thoroughly reliable. He has an ambition to become an agent in a small place and will doubtless receive such promotion in the near future. In the test, which occupied one hour and fifty-five minutes, he earned a mental age of 9-2. Four months later, at the request of the writer, he was given the same test by Dr. Kohs. On this retest, giving him the benefit of every possible doubt, he earned a mental age of 10-5. At the same time Dr. Kohs gave several performance tests which, while they have not been carefully standardized, gave added evidence that this man has a mental equipment not above that which is normal for an average ten-year-old boy. He is earning $90 a month and doing a type of work which makes him a very useful citizen. He illustrates the necessity for the distinction between intellectual feebleness and social feebleness which has been frequently pointed out by Dr. Terman. This man is definitely limited intellectually, but he can not be classed as feebleminded in any reasonable sense of that term.

Subject No. 3 came to the test immediately after No. 47 and was estimated as having a mental age not above 13; he earned one of 18-6. He was born in England, of English parentage. He is 36 years old and has been in the United States four and a half years, having been with the express company all of that time. He is a helper to the C. O. D. Clerk and a very faithful employee. Previous to coming here he worked with his father, who is a grain merchant. He attended University College, London, for a year and refused to return because of a feeling of friendlessness. He had won first rank in a preliminary examination and if he had taken the major examination would very likely have won a scholarship that would have paid his expenses at either Oxford or Cambridge. As a boy he was extremely nervous; frequently got up at night to look for someone he believed to be in the room. His manner is retiring and unresponsive. There is very little expression in his face. He is very conscious of a speech impediment which, however, he has now quite largely outgrown. What a lot of needless suffering he would have been spared if he could have had, when young, the training which would have remedied this defect! Moreover, we cannot estimate the increase in value of his service to society which this might have meant; for it was precisely the consciousness of his defect that was the underlying cause of his feeling of ostracism while at school and which, directly or indirectly, has doubtless affected also his whole subsequent career.

Brief mention will be made of two other cases. Subject No. 11, who is 55 years old, of Scotch-English parentage, earned a mental age of 16-11. He left school at the end of the 8th grade, has been with the company 34 years, and for the past five has been a Money Clerk. He is spoken of as being supersensitive, jealous and quarrelsome with his superiors. He will probably never be promoted. Subject No. 41 is 25 years old, American with English-German antecedents. He earned a mental age of 13-6; left school at the end of the 4th grade and has done no additional studying since. He stated that he had an ambition to become a mail clerk, but was doing nothing definite towards achieving that end. He has been with the company five years. He has received an increase in salary of $20 per month in less than a year and is being considered at the present time for further promotion. He was referred to as one of the most promising of the group.

VARIABILITY OF THE EDUCATION OF UNEMPLOYED MEN[1]

HERBERT A. TOOPS and RUDOLF PINTNER, Ohio State University

During the past two years the writers have collected a large amount of data in regard to the final educational attainments of unemployed men. From these data has been derived evidence to point to the probability that education, wages, and industrial success are in large degree dependent upon the intellectual ability of the men. With the records at hand and a knowledge of the changing conditions in industry during the two years, it is now desirable to investigate the relation of education to the type of men applying at any particular time or season, and under different industrial conditions,—in brief, the changes in the educational attainments that may be noticed in an employment office over a period of time.

This report deals with the results obtained from the records of the applicants for positions at the Dayton, Ohio, Free Employment Office during the years 1916 and 1917, giving a more complete analysis of the results for the latter year. A tabulation by grades and by months was made of the "grade at leaving school," as reported on the registration cards of the 7,020 newly registering applicants who reported this item in 1916, and of the 9,506 new applicants who reported the item satisfactorily in 1917.

We at first wish to know whether the educational attainments of the applicants as a whole have changed during the period under consideration. If we make the assumption, merely to have some substantial basis upon which to make our calculations, that a grade "8" as reported means eight grades completed, then the median grade at leaving school will probably best give the desired information. We also wish to know whether there has been any change on the whole in the type of men as to education, whether more or fewer men of high and low educational attainments respectively applied in the one year than in the other, and finally, if any

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[1] The writers wish to acknowledge their indebtedness to Mr. Eugene A. Mead, Superintendent of the Dayton State-City Free Employment Office, without whose cooperation and encouragement this report would not have been possible.

TABLE I. GENERAL COMPARATIVE RESULTS OF THE EDUCATIONAL ATTAINMENTS OF THE DAYTON FREE EMPLOYMENT OFFICE APPLICANTS FOR THE YEARS OF 1916 AND 1917.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Number of Cases:													
1916	675	598	470	603	639	580	570	627	544	513	606	595	7020
1917	609	343	472	555	818	941	1287	1152	682	699	848	1100	9506
Median Grade at Leaving school:													
1916	8.23	7.89	8.27	8.15	8.14	8.31	8.40	8.32	8.30	8.43	8.35	8.28	8.28
1917	8.17	8.26	8.12	8.28	8.28	8.21	8.28	8.31	8.26	8.34	8.36	8.37	8.30

change is noted, we wish to know more about the changes and the men causing the changes.

Table I shows the number of men reported upon by months and the median educational attainments of the applicants by months for the two years.

We note that, in spite of the fact that the total number of reporting applicants increased by about 26 per cent in the second year and that for particular months the percentage of applicants in 1917 was about twice that of 1916 due to unusual industrial conditions, the median attainment in education for the two years is almost the same, 8.30 grades of school completed by the 1917 applicants as compared with 8.28 grades by the 1916 applicants. If we consider the monthly medians, we note but little change in these also. Even the greatest of the differences could be produced by the shifting of about a dozen men from one extreme of the distribution to the other. Such stability of the central tendency is characteristic only of distributions which have a very fundamental property of humanity as an underlying basis. About all that one can say of the slight amount of variation which is probably significant, is that in general the medians are lower in the winter and spring months and higher in the summer and autumn months than the average grade for the entire year. During the summer and autumn months of 1916 the office placed many skilled mechanics in positions in munition factories and also many mechanics who were out of jobs because of a strike; yet the large number of these presumably better educated men did not raise the median of the group to any appreciable extent. In the summer of 1917 the office was called upon to supply many men, of whom many were skilled, to the aviation construction camps and to the army cantonment construction camps; and again the monthly medians are not affected to any great extent. Then in the fall months of 1917, a change in the attitude of employers towards the office was effected. The office had proved itself so efficient in securing good men during the summer months that the large manufacturers of the city mutually agreed to stop all advertising for employees and rely entirely upon this office for their new employees. Yet in the fall and winter months of 1917 we note but little change in the monthly median attainments although the median does seem to be on the upward trend. The policy of this office has been in the past to discourage the applications of undesirable men and to encourage the applications of high-grade men. Why, then, with the large increase in number of high grade men that is known to exist in 1917, do not the median educational attainments of the group change more appreciably?

To answer this question it is necessary to study intensively the distributions of the men by the grades at which they left school and by the different months of the year. We must determine the changes that have gone on from month to month and note whether there is an increase or decrease of poor, fair and well educated men as time goes on. An examination of the crude number distributions by grade and by month of registration can give us no clue to the information which we are seeking. Such a distribution table is too lengthy to be given here. It is readily apparent that the crude numbers can have no value for us unless taken in connection with the total number of applicants during a given period of time under consideration. To illustrate: If the number of applicants who had a second grade education and who registered and reported their education during May was *twice* as great as the number with second grade education who registered in April, but the total number of applicants in May was only *half* of the number registering in April,—then the relative increase of the number with a second grade education in May over the number with second grade education in April is 300 per cent, and not 100 per cent as given by the crude numbers; or, the ratio we desire is *four* and not *two*. We can then say that the number of second grade applicants has relatively increased to four times the number in April. The ratio desired for our comparisons, then, amounts to dividing the number of applicants in a given month with a given amount of education by the corresponding number which is to be expected in that month when the total increase of that month over the preceding month is taken into account. It can be easily shown that what this amounts to mathematically is dividing the per cent with the given grade of education at the particular month under consideration by the percentage at the same grade for the preceding month or for the time period with which it is to be compared.

If, N*J*[2]=the total number of reporting applicants in January,
N*F*=the total number of reporting applicants in February,
n*J*=the number of second grade applicants in January,
n*F*=the number of second grade applicants in February,

then the number of second grade applicants in February, if there were no relative increase or decrease of second grade applicants, who are expected by reason of the change in the total number of applicants in the two months, is

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[2] The italicized letters indicate modifiers, not algebraic factors.

$$EF = \frac{NF}{NJ} nJ$$

But usually nF is not equal to EF (the number to be expected) for the reason that there is some relative change in the numbers in the two months. *Our ratio, or index of comparison of the number of second grade applicants in February with respect to January, then, is,*

$$I = \frac{nF}{EF},$$

or,

$$I = \frac{nF}{\frac{NF}{NJ} nJ} = \frac{nF}{NF} \frac{NJ}{nJ}.$$

We may write this expression in the following form,

$$I = \frac{nF}{NF} \div \frac{nJ}{NJ}.$$

The index of comparison of the number of second grade applicants in February to the number of second grade applicants in January is thus the quotient obtained by dividing the per cent of such applications in February by the corresponding per cent in January.

When this index is 1.0, there is no relative change; when the index is less than 1.0, there has been a relative decrease, and when the index is greater than 1.0 there has been a relative increase of second grade applicants in the second month with respect to the first. An index of 1.20 in the above case would mean that the second grade applicants in February had relatively increased 20 per cent over the number of such applicants in January.

We have then but to reduce the grade distributions to percentages and divide the percentage in the second period at any given time period by the percentage in the same grade at any preceding period with which we wish to compare it. The index has the value, which a comparison directly of the crude percentages has not, that equal gross differences, say at the first and eighth grades, are shown in their true perspective as regards the per cent of relative change. One per cent of gross difference in the first grade is a much greater relative change than one per cent gross change at the eighth grade, because the actual percentage upon which the relative change is based is much larger in the eighth grade than in the first grade.

If we reduce our distribution table of percentages to these index numbers, we get a result that is almost as bewildering as at first, so far as being able to understand the changes that have taken place in the composition of the group. Accidental or chance changes in the gross numbers by months and by grades play a large part in the determination of the index

TABLE II. NUMBER AND PERCENTAGE DISTRIBUTIONS OF 1917 APPLICANTS BY GRADE GROUPS AND BY SEASONS OF THE YEAR

Grade Group	Numbers—						Per Cents—					
	Jan. Feb.	Mar. Apr. May	June July Aug.	Sept. Oct. Nov.	Dec.	Total for Year	Jan. Feb.	Mar. Apr. May	June July Aug.	Sept. Oct. Nov.	Dec.	Total for Year
None, 1, 2......	48	94	129	89	39	399	5.05	5.09	3.82	3.96	3.55	4.23
3, 4............	84	154	251	162	69	720	8.83	8.35	7.34	7.26	6.27	7.56
5, 6............	178	330	596	383	179	1666	18.71	17.88	17.55	17.02	16.28	17.52
7..............	102	205	368	219	116	1010	10.72	11.10	10.87	9.82	10.54	10.62
8..............	305	585	1118	804	396	3208	32.07	31.70	33.08	36.70	36.00	33.74
I..............	70	171	319	173	102	835	7.35	9.28	9.44	7.76	9.28	8.78
II, III, IV......	143	256	502	333	174	1408	15.05	13.88	14.85	14.80	15.82	14.83
A, B, C, D, E...	22	50	97	66	25	260	2.36	2.75	2.87	2.94	2.28	2.73
Total.......	952	1845	3380	2229	1100	9506	100.14	100.03	99.82	100.26	100.02	100.01
Median G.......	8.21	8.26	8.31	8.33	8.37	8.30	—	—	—	—	—	—
1916 Median....	8.23	8.16	8.34	8.36	8.28	8.28	—	—	—	—	—	—

TABLE III. INDICES FOR COMPARISON OF GRADE GROUPS BY SEASONS OF THE YEAR

GRADE GROUP	INDEX FOR SEASON —					Total for Year
	Winter	Spring	Summer	Autumn	Winter	
None, 1, 2	1.00	1.01	.76	.78	.70	.84
3, 4	1.00	.95	.83	.82	.71	.85
5, 6	1.00	.96	.94	.91	.87	.94
7	1.00	1.04	1.01	.92	.98	.99
8	1.00	.99	1.03	1.14	1.12	1.05
I	1.00	1.25	1.28	1.06	1.26	1.19
II, III, IV	1.00	.92	.99	.98	1.05	.99
A, B, C, D, E	1.00	1.17	1.22	1.25	.97	1.16

TABLE IV. PER CENT OF RELATIVE INCREASE OR DECREASE OF GRADE GROUPS OVER THE CONDITIONS PREVAILING AT THE BEGINNING OF THE YEAR, BY SEASONS OF THE YEAR

GRADE GROUP	PER CENT OF INCREASE OR DECREASE					Total for Year
	Winter	Spring	Summer	Autumn	Winter	
None, 1, 2	0	1	—24	—22	—30	—16
3, 4	0	— 5	—17	—18	—29	—15
5, 6	0	— 4	— 6	— 9	—13	— 6
7	0	4	1	— 8	— 2	— 1
8	0	— 1	3	14	12	5
I	0	26	28	6	26	19
II, III, IV	0	— 8	— 1	— 2	5	— 1
A, B, C, D, E	0	17	22	25	— 3	16

numbers. We have made the meaning of the changes more readily apparent by the following procedure. The table of distributions was regrouped by adding together several grades of low frequencies and then grouping these frequencies into still new groups on the basis of the seasons of the year. By this procedure, accidental changes in the distributions are so averaged that their effect is practically negligible. These frequencies, both in numbers and per cents are shown in Table II. The upward trend during the year is then clearly apparent by the medians alone.

If we take the percentage frequencies of the winter months, January and February together, to represent the conditions at the beginning of the year and compare all the other percentage frequencies with these, by the method above described, we get the indices of Table III. Since these indices may be taken to represent the relative percentages which each period is of the conditions prevailing at the beginning of the year, we have but to subtract 1.00 from each index to get the per cent of relative increase in a particular group of grades throughout the year (Table IV). Thus, if we subtract 1.00 from the index for the summer months (June, July, August) in the eighth grade, we find that the eighth grade applicants in the summer months have relatively increased by 3 per cent over the eighth grade applicants in the winter months of January and February together. A negative percentage in the table means a decrease.

Now let us see how these last two tables help us to understand the relation of education to the kind of applicants applying at different times and under different industrial conditions. We at once note from Table IV the relative decrease throughout the year of all men with education less than an eighth grade education, as is shown by the negative signs. The eighth grade and I-year high school men are rapidly increasing in relative importance. From Table III we note that, for the whole year, the 7-grade men and the II, III and IV-year high school men together have made but little change while there have been large gains made in the relative percentages of the eighth grade and I-year high school men and College Men (A, B, C, D, E). The two most significant relative increases are in (1) the eighth grade, which has the largest gross total of applicants of any grade and in which small relative changes mean large changes in gross numbers and (2) in the I-year high school. The relative increase in the College applicants is not so important for the reason that the group has a rather small gross number in it. We also note that the rate of relative decrease of the lower grade men is seen to slow up with the approach of the winter months.

We may derive several conclusions from the above figures. With the changing of the attitude and policy toward the office and the calls made upon it to send out skilled workers in larger and larger numbers, we note that there is a decided increase in the relative proportion of eighth grade and I-year high school men, a fact which means that there is a relatively large gross number of these men applying at the end of the year as compared with the beginning of the year. To make up for the increase in these two grades we have then consistent decreases in the relative importance of the men of lower grades, the largest relative decreases being in the case of the men with least education. What that means from an industrial standpoint, since the number of men actually hired by employers bears a rather constant relation to the type of applicants, is that where given the chance to choose their employees from men of all degrees of education, employers are choosing their men with the better education wherever possible. If we regard the number of men in the lowest grade group (no school, first and second grades) in Table II we note that the gross numbers of these poorly educated men decrease but little, although they show a tendency to increase with the approach of winter or at least to decrease at a slower rate than in the summer months. What this probably means is that the places which they might have held in the industrial world are being taken by better educated men, and that they still keep on applying at the office for work, since their number does not decrease to any great extent although their relative importance is decreasing. The men with little education are thus a rather stationary class. We have good reason to believe that these are often men who are mentally incompetent, and that whatever makes for mental inefficiency makes also for educational and industrial inefficiency. Consequently these men are last to be hired and first to be thrown out of jobs when the employer has the choice between poorly educated men and the better educated men. The choice exercised by the employer is not made because of the poor education but because of industrial inefficiency. Indeed, the test administered by the employer is not the amount of education of the applicant but an industrial test,—whether or not the applicant is able to do the work for which he is to be hired. Lack of education and industrial inefficiency are thus probably both a result of poor intellectual endowment. That the men of poor education are relatively more numerous in the winter than in the other seasons is no doubt due to the fact that such men, when employed, work at such work as can be carried on during the spring, summer and autumn months only. Industry, too, is usually more active during these periods so that there would be a greater chance for some of them who had rather a poor education but a fair amount of intellectual endowment to obtain jobs in competition with men who are better endowed intellectually and are generally better educated. It is not, of course, maintained that poor education is always found only among poor or undesirable workers, but in general this would seem to be true.

The lower grade men are decreasing in relative importance but not greatly in actual numbers. The eighth grade and I-year high school men, *i.e.*, those around the median educational attainment, have increased both in numbers and relative importance. There is a decrease in the relative importance of the men of the last three high school grades with but little change in the absolute numbers. These three facts then are sufficient to explain why the median attainment has changed so slightly. The median deviation of the 1917 distribution is less than that of the 1916 distribution; the cases are grouped more densely about the median. The men from the last three high school grades, while being perhaps even more desirable employees, are few in number in the community and so cannot change the median attainment to any very great extent even if all were included. Of the few who are in the community, most of them are probably permanently employed and so do not have occasion to come to the employment office. Consequently then, if all employers of the city were to demand only better educated men, they would have to recruit most of them from the seventh, eighth and I-year high school men.

Such distributions point to a very fundamental principle underlying not only education but industry as well. All people of a population (industrial workers and otherwise) have varying intellectual endowments, which are distributed according to a curve of normal distribution, and which influence the industrial success and school attainments of the population to just about that degree in which the respective degrees or measures of mental endowment are found to occur.[3] Since, considering all the working population, the frequencies of these degrees of mental endowment do not change, *i.e.*, are hereditary and hence change very slowly, if at all, in the general population,—we should expect the median amount of education at any time to approach to a constant value; and we should expect the education of any industrial group to be made up of different proportions of men of the respective amounts of education according to the amount of competition for positions, and the possibilities of employers choosing their men from all possible grades of men. The employers choose, whenever possible, the better educated men not because of their better education primarily, but because of their better intellectual endowments which enable them to make better adjustments to their work. This, in turn, makes them more satisfactory employees.

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[3] Pintner, R. and Toops, H. A.—Mental Tests of Unemployed Men. *Journal of Applied Psychology*, Vol. I, No. 4, 1917, pp. 325-341.

And also, by the same authors, Mentality In Its Relation to Elimination from School. *School and Society*. To appear shortly.

AN EXPERIMENT IN INFANT EDUCATION

INTRODUCTORY STATEMENT

By LEWIS M. TERMAN, Stanford University

The following article was written at my urgent request by the father of Martha. The statements it contains border so closely on the incredible that I have thought best to state here briefly what I know about the child.

Martha lives within a few miles of Stanford University. Her father is a lawyer, having graduated from Stanford University at the age of 21 years. The mother was a teacher before marriage. I first saw Martha on the evening of March 31, 1918. At that time she was a few days more than 26 months old. Several times I had heard of her as a child prodigy who was able to read like a school child. On the day just mentioned Martha's father brought her to my home and allowed me to observe her reading ability. Her performance was quite beyond anything I had deemed possible for a child a little more than two years old. She read from any primer fluently and with better expression than most first grade children are capable of. Her pronunciation, however, was babyish as one would expect in the case of a child who had only talked one year. Given primers which she had never seen, she read from any starting point without hesitation. Whenever she came to a word she did not know she said, "What's that?" In one little lesson she was given to read, four new words were encountered and pronounced for her. An hour later she was able to recognize all of these even when they were shown to her in word lists at the back of the book. I did not undertake to measure her reading vocabulary, but from what I heard of her reading I am convinced that it is larger than that of the average child who has spent ten months in the first grade.

I have known Martha's father for approximately three years and I wish to say that his statements in the following article should be accepted without the slightest discount for paternal pride or faults of observation. He has made the article a plain statement of fact, leaving each reader to interpret the interesting phenomenon according to his own theories.

One other pertinent fact should be mentioned: Martha's oldest brother, 11 years old at this writing, has the highest intelligence quotient I have found among California children. At nine years he tested 171, and a year later 172. At 11 years he is leading his class in the eighth grade. This boy was given a course in intensive mind culture similar to that employed in the case of Martha, only not so early in life. In his fourth year he could read various primers and at the age of six he devoured books which are ordinarily not read by children below the fourth grade. There is one other child in the family, a boy two years younger than John. This boy is making an average record in the third grade and seems to be little if any more advanced in intelligence than the average child of his age. This boy enjoyed no special instruction like that given the other two children for the reason that the father at that time was fully occupied by professional duties.

It is interesting to conjecture to what extent the precocity of John and Martha was due to the educational stimulation they received, and to what extent the average condition of the other child is the result of the omission of such stimulation. The question can here only be raised; but it is within the possibilities of psychology to find, by properly controlled experiments, an answer to this and similar questions relating to the plasticity of the human intellect. Is it too much to hope that the experimental psychology of the future will concern itself more with the dynamics of mind and character than it has in the past?

By Martha's Father

Up to the age of nineteen months my daughter, Martha S., was apparently a normal child mentally and physically. She began to talk and to walk at the usual age and her progress in these particulars was neither more rapid nor slower than that of the average child.

At the age of about fourteen months she had acquired the use of her first three words, "mamma," "papa," and "pretty." I then began an experiment in child education which has continued, more or less intermittently, up to the present time. I had heard of certain infants who showed great precocity at early ages, and was moved by curiosity to attempt to discover for myself whether such children are specially gifted by nature with unusual mental powers or whether the same development might not be attained by any normal child such as Martha appeared to be.

I had no access to any of the literature on the subject, and, indeed, up to the present time have not read any book or article dealing with cases of early mental development and the methods employed to secure it; nor have I ever been a teacher or particularly interested in educational matters. The results obtained, therefore, have naturally been limited by the fact that I was a rank layman pioneering in a field to me unknown, without knowledge of educational methods and compelled to rely upon such crude expedients, in lieu of methods, as might suggest themselves to a lay mind. In view of the measure of success which has attended an experiment undertaken under such obvious disadvantages, it is safe to assume that had the same experiment been carried out consistently and uninterruptedly by a qualified educator, the success would have been proportionately greater.

As an initial step I cut from red cardboard a number of large capital letters and tacked them on the living room wall among the various pictures hanging there. In moments of leisure I took Martha in my arms and walked from picture to picture naming the objects represented. Occasionally I stopped before one of the letters and said "See pretty B," "There is O," or "See M," as the case might be. In a few days she was able to recognize B, and her fourth spoken word was "pretty B." At this time she learned to recognize three or four of the capital letters; but her progress was slow and disheartening, and as spring work on the ranch was coming on, I dropped the experiment altogether. From that time for about five months no special effort was made to direct her mental development, which proceeded normally. I did, however, in spare moments make it a practice to point out various objects and to pronounce their names slowly and distinctly, with the result that her vocabulary of nouns was rapidly increased.

One day when she was about nineteen months old her aunt showed her the pictures in a nursery book, in which she at once became greatly interested, and from that time her mental development has been rapid. While it is doubtless unsafe to generalize from the results of a single experiment of this kind, my experience with Martha leads me to believe that the secret of unlocking the wonderful powers of the baby mind lies in securing its *interested* attention to matters of educational value, and that by far the most effective means of arousing such interested attention is the nursery picture book, properly employed.

I placed in her hands a book which, in addition to a number of pictures interesting to the child mind, contained capital letters in flaring type and colors. She at once became interested in the pictures and fell into the habit of rushing to me, whenever I entered the house, to have me show them to her. At these times I took her on my lap, turned to a picture, told her what the objects represented were, and chatted about them in such fashion as seemed most to arouse her interest. Occasionally I turned suddenly to the pages of capital letters, pointed to one of them, and exclaimed with feigned excitement, "Oh Martha! Look! Look! There's P!" Then, without giving her time to discover the deceit and to determine for herself that after all there is nothing wildly exciting about the letter P, I returned to the pictures and excited her interest in the vicissitudes of Tom the Piper's son, only to turn back after a few moments and point with an exclamation to another letter. The pictures were unquestionably of great interest to her, and as the references to the uninteresting capitals were only occasional and momentary, the net result of these sessions was that she found the book as a whole a great joy, failed to discover the camouflage in the matter of the letters, and nevertheless became familiar with them. When she was nineteen months and thirteen days old she was able to recognize and pronounce all of the capital letters.

Although I am informed that the method of teaching a child to read by first teaching it its letters is decidedly out of vogue, I nevertheless continued in that error, if error it be, and next proceeded to teach Martha the small letters. As I had no picture book containing the small letters in showy type, I was compelled to resort to another expedient. I drew the letters carefully on the back of business cards, and kept a few of these in my pocket. When she grew tired of looking at pictures I allowed her to play with these cards, of course calling her attention from time to time to the letter on the back of each. She became interested about this time in exploring my coat pockets and pulling the contents out of them, so I sometimes placed a few cards in a pocket open to attack, and allowed her to pull them out one at a time, refusing to let her have a new card until she pronounced the letter on the one already pulled out. As this refusal constituted an obstacle to an interesting investigation, she sensibly surmounted it by observing the letters and pronouncing them in order to experience the joy of delving into the depths of the pocket for a new card. At other times I varied the play by sitting down with a pack of the cards in my hand and giving them to her one at a time to be carried by her across the room and delivered to her mother or aunt, refusing to give her another until she told mother or aunt the name of the letter on each card delivered. Both mother and aunt always displayed a highly gratifying interest and astonishment at all information so volunteered by her, and she doubtless felt that she was playing a very important rôle in an extremely important matter. At any rate she enjoyed the process immensely and incidentally learned her small letters.

When she was twenty months old she knew both small and capital letters thoroughly, and I next proceeded to teach her to read. For the initial steps the picture books were again resorted to. In passing from picture to picture I occasionally dropped down to the reading matter, placed my finger under the word "the," and said in a casual manner, "And there is 'the,' Martha," proceeding instantly to another picture before that wholly uninteresting image of a word could detract from the vivid interest aroused by the pictures. In a few days she knew "the" and had no difficulty in picking it out herself in a page of print. Several other words, such as "book," "man," "fat," "boy," and "girl," were taught in the same way. These words were then transferred to the backs of cards and thoroughly fixed in her memory by following out the series of plays used in teaching the small letters.

As I felt that the type in ordinary primers would be too small for a child of her age, and as an examination of a number of these primers indicated that much of the matter related to things beyond her knowledge, I determined to prepare my own primer. I accordingly purchased an ordinary five cent composition book, cut highly colored pictures from magazine advertisements, pasted them in the book, and printed under them simple words referring to the pictures in letters half an inch high.

Her interest in this book was confined almost exclusively to the pictures, the reading matter in itself making no special appeal to her. She wanted to see the pictures; before a page was turned and a new picture brought to view it was necessary to pronounce the words, and she did so as a means to getting to something enjoyable. Of course new words were gradually added on succeeding pages. Although the words were arranged in short sentences she did not at first realize any connection between the words or grasp the idea that these words as combined expressed a thought. Each word was for her a picture without relation to other pictures. When she was twenty-one months and ten days old the idea that these word pictures represented thoughts sudenly dawned upon her while pronouncing the words "I see mamma" written under a photograph of her mother. This discovery was attended by every indication of mental pleasure, and from that moment she began to read in the true sense of the word. I find from my records that on that day she had a reading vocabulary of thirty-five words and could distinguish between and name the primary colors.

It may be observed that up to this time the process of teaching was one of indirection. No effort was made to interest her directly in characters or words to be memorized. These were, on the contrary, studiously kept in the background, and her attention was directed to them only casually and momentarily from time to time in connection with pictures or matters which aroused and held her interest. In a world overflowing with things interesting to the baby mind it is a difficult task to secure direct concentration on such uninteresting things as letters and word pictures.

The difficulty of securing such direct interest in reading matter now began to manifest itself. With each additional lesson added to the home-made primer the number of words in proportion to pictures increased, and Martha's interest began to decrease in much the same proportion. The reading matter was assuming a prominence which no longer made it incidental to the pictures, but which threatened to make the pictures incidental to it; and as she had not reached the stage where the act of reading in itself afforded pleasure, she began to get suspicious of a book in which interesting pictures appeared only between arid stretches of word pictures. It was now necessary to bridge the difficult gap between this point and the point at which the act of reading would begin to be a pleasure by reason, not of the accompanying pictures, but by reason of the thought conveyed. To that end I resorted to all sorts of expedients, some of them doubtless ridiculous. To encourage her I once applauded her by clapping my hands after she had finished reading a page. That pleased her, and when she finished another page she demanded more applause. Finally it came to be understood that whenever she finished reading a page all present must break out into riotous handclapping. This outburst of applause was so pleasing to her that she began to seek the opportunity of reading in order to provoke it. Often after wading almost through a page and observing that she was within a line or two of the bottom, she would cease reading, look up with eyes dancing with joyous expectation, and exclaim "Pretty soon patty-cake!" (clap). Later on, when handclapping had lost something of its novelty I once became so enthusiastic after she finished a difficult page that I broke out in the chorus of "Marching through Georgia," beginning, of course, with the words "Hurrah! Hurrah!" That also tickled her fancy and for a time she read for the purpose of hearing this chorus bellowed by the family at the end of each page. At other times she read for the purpose of being tossed up in the air or of being taken out to see the stars. When all these failed I fell back on rewards and, to some extent, on downright compulsion. Her small allowance of candy was cut off and she was given to understand that she could have candy only by reading for it. If the promise of candy was insufficient to coax her away from her dolls and toys a piece would be placed on the table in plain sight until she surrendered and expressed a willingness to read for it. On a few occasions, when everything else failed, I even resorted to a light spanking to get her started to reading. I mention this fact not because I believe it to be a method to be recommended; but in order to make this record a true one. I now feel that by the exercise of a little more patience and ingenuity I could have surmounted all difficulties by more rational methods. By the time she was twenty-three months old she began to experience the mental pleasure of reading, and the necessity for these methods passed.

Her reading was supplemented with the cards until her vocabulary increased to about seventy-five words. She then began to exhibit an aptitude for assimilating new word forms which rendered further use of the cards unnecessary.

In the reading matter specially prepared for her capital letters were eliminated entirely except in the case of proper nouns. She was reading by the word method in which each word is in effect nothing more nor less than a picture with a given name. Considered as a picture, the picture "the" is decidedly different from the picture "The;" and it clearly confused the child to hear the same name applied to dissimilar pictures. When she was far enough advanced to begin the use of printed school primers she no longer had any difficulty in recognizing words beginning with capitals.

The composition book primer was not wholly satisfactory. Its leaves were of such flimsy paper that in the hands of a baby they were readily torn; and we were obliged to keep it out of her reach except when an older person could be present to watch over it. To obviate this difficulty I procured a sheet of artificial wall-board of the type of "Beaver Board," and sawed it into pieces about nine inches long by seven inches wide, on which the lessons prepared for her were pasted. The boards so prepared were practically indestructible, and served not only as a reading text, but as a toy as well, with which the baby might play at her pleasure. Martha took kindly to these boards, and when twenty-three months old ordinarily spent as much as an hour each day on the floor, playing with the boards, and reading the lessons aloud to herself. After she had mastered the contents of some fifteen of these boards, had acquired a reading vocabulary of about one hundred and fifty words, and had developed considerable proficiency in reading, ordinary school primers were placed in her hands.

At the age of twenty-four months she had a reading vocabulary of over two hundred words. She is at the time of this writing twenty-six and one-half months old, and has a reading vocabulary of over seven hundred words. In addition to the matter specially prepared for her on the boards, and in addition to considerable matter mastered in various nursery books, she has finished four school primers and is about half way through a fifth. Her vocabulary of spoken words is very extensive, so much so that I have given up trying to keep track of it; but it must be well over two thousand words. Her pronunciation has by no means kept pace with her progress in reading; but her expression while reading leaves little to be desired.

Because of lack of time very little has been attempted in the way of developing her mathematical sense. When she was twenty-one months old she had acquired the use of the words "one," "two," "three," "four," "five," "six," and "seven," but without any concept of the number value expressed by the words. At that age I spent many hours, and exhausted every resource of my ingenuity in an attempt to get her to recognize the number of objects up to three, but without success. She had absolutely no mathematical sense at that age, although her ability to recognize colors and word forms was already well developed. The first glimmering of a mathematical sense appeared during her twenty-third month, when she began to count small groups of objects correctly. By the time she was twenty-four months old she recognized and read the printed numerals up to 100, and correctly counted groups of objects up to ten. No effort has since been made to develop her mind in this direction.

Owing to pressure of other matters I have been able to give her little attention since her twenty-fourth month; and for some time have devoted to her only a half hour or so in the evening two or three times a week; so that her development, considerable as it is, by no means approaches the limits of possibility. Indeed, I am much impressed with the idea that the limits of the baby mind have never been sounded. It appears to be capable of performing feats beyond the powers of the mind of either the adult or the child of school age. As an illustration, it is no unusual thing for Martha, when conditions are favorable, to cover twenty pages of simple new matter in a primer and add twenty or more new words to her vocabulary in a single session of half an hour. The instant her eye encounters an unfamiliar word she exclaims "What's that?" I pronounce the word for her once, or at most twice, have her repeat it, and it is stamped in her memory; and thereafter she recognizes and pronounces it in whatever connection she meets it. In doing this she receives no aid from phonics. Up to the present time she reads by the word method only. The lightning-like rapidity with which her mind, apparently without effort or concentration, assimilates new word forms is almost uncanny. Since beginning this article I have had an opportunity to put this ability to a somewhat strenuous test. I brought the child to my office to spend the day with me away from the distracting influences of family life. I gave her a primer she had not previously seen—"Gordon's Reader, Book I." She read, with frequent intervals of happy play, for about three hours and a half, when she rebelled and refused to read further. During this period she covered the first forty-four pages of the primer (excluding three pages of verse), or a total of 2,464 words. In this number of pages she encountered fifty-one unfamiliar word forms, which were pronounced for her until she was able to repeat them, but which were not reviewed. The book was then put away for thirty hours, at which time of the fifty-one new words she recognized thirty-eight and failed on thirteen.

As the baby mind doubtless foreshadows the mind of the child of school age, a fact observed during the course of the experiment should be of interest to the educator. While it is true that her baby mind is capable of feats beyond the powers of older minds, this power displays itself in its highest perfection only during those hours of the day when her physical vitality is at its best. When physical weariness supervenes the collapse of the mental powers is more absolute and complete than in the case of an older child. In Martha's case, her mental powers are not at their highest immediately after awakening from a refreshing sleep. They begin to sparkle about two hours after she awakes, blaze forth in their greatest brilliancy four, five, or six hours after awakening, and then gradually decline. As bed time approaches they die out almost completely. Then, even if she expresses a desire to read, as she often does, her mind wanders from the printed page, she is unable to assimilate new word forms, which leave no impression on her memory, and she completely forgets words with which she has long been familiar.

Since undertaking the experiment I have been warned by kindly friends against "over-taxing" the baby's mind, and have been favored with citations from the works of educators containing grave warnings against straining the mental powers of the young. The answer to such warnings appears to me to be, first, that the baby mind is naturally intensely active, and if Martha had been left to her own devices during the periods devoted to teaching her, her mind would have been just as actively occupied with something of no ulterior value to her as it was in fact occupied with learning to read; and second, that it is impossible to drive the baby mind beyond that which affords it pleasure, whether such pleasure is found in an act itself or in anticipation of a reward for doing the act. I have stated that at one stage in her development I occasionally lightly spanked her to get her to read, and, unexplained, this statement might imply that I thereby forced her to mental effort. The fact is, however, that the spanking merely served to wrest her attention from dolls and toys. When her attention was so diverted I directed it to the reading matter, a new interest and pleasure supervened, and she forgot her dolls. When the time comes, as it often does, when reading ceases to be a pleasure to her, and her interested attention can no longer be commanded, I have yet to discover a method of forcing her to proceed.

AESTHETIC JUDGMENTS OF SCHOOL CHILDREN

By Anna Berliner

The problem in these experiments was to find how various groups of children would rank a series of picture cards according to the aesthetic value of the pictures. The experiments were carried on with nine groups of twenty grammar school boys and nine groups of twenty grammar school girls chosen at random from the grades 8 B, 6 B, 6 A, 5 B, 5 A, 4 B, 4 A, 3 B, and 3 A of the Hebrew Orphan Asylum, New York City. The material used for the ranking consisted of 16 picture postals representing illustrations of rhymes and songs for children. The pictures were spread out at random on a table, and the child asked to find the most beautiful of all. As soon as the child had selected a card he was told to find the most beautiful of those that were left. This demand was repeated again and again until the child understood that he had to go on finding the most beautiful of those that remained. Each child was taken separately and was not allowed to see how the other children arranged the cards. The average position for each card was calculated, and the resulting eighteen series of values were correlated in the following way: each group of boys was correlated with each group of boys; each group of girls was correlated with each group of girls; and finally each group of boys was correlated with the corresponding group of girls, so that class 8 B of the boys was correlated with class 8 B of the girls, class 6 B of the boys was correlated with class 6 B of the girls, and so on. The correlations were found by the product-moments' method of Pearson. They are given in table 1, table 2, and table 3. With one exception (table 3, 6 A) all three tables show high correlations and a small probable error, a fact which justifies the following conclusions:

1. *Between the limits of grade 8 B and grade 3 A, and under our conditions, the ranking order of a group of pictures is to a high degree the same for all the grades.*

2. *Between the limits of grade 8 B and grade 3 A, and under our conditions, the ranking order of a group of pictures is to a high degree the same for both sexes.*

TABLE 1*

CORRELATIONS OF BOYS' CLASSES WITH BOYS' CLASSES

	8 B	6 B	6 A	5 B	5 A	4 B	4 A	3 B	3 A
8 B		0.80 0.06	0.34 0.15	0.61 0.11	0.50 0.13	0.71 0.09	0.56 0.12	0.42 0.14	0.37 0.15
6 B	0.80 0.06		0.40 0.14	0.81 0.06	0.48 0.13	0.89 0.15	0.61 0.11	0.69 0.09	0.63 0.10
6 A	0.34 0.15	0.40 0.14		0.49 0.14	0.71 0.09	0.44 0.13	0.58 0.11	0.15 0.16	0.47 0.13
5 B	0.61 0.11	0.81 0.06	0.49 0.14		0.55 0.12	0.99 0.02	0.73 0.09	0.75 0.07	0.73 0.08
5 A	0.50 0.13	0.48 0.13	0.71 0.09	0.55 0.12		0.60 0.11	0.71 0.08	0.52 0.12	0.56 0.12
4 B	0.71 0.09	0.89 0.15	0.44 0.13	0.99 0.02	0.60 0.11		0.73 0.08	0.79 0.06	0.67 0.11
4 A	0.56 0.12	0.61 0.11	0.58 0.11	0.73 0.09	0.71 0.08	0.73 0.08		0.60 0.11	0.80 0.06
3 B	0.42 0.14	0.69 0.09	0.15 0.16	0.75 0.07	0.52 0.12	0.79 0.06	0.60 0.11		0.77 0.07
3 A	0.37 0.15	0.63 0.10	0.47 0.13	0.73 0.08	0.56 0.12	0.67 0.11	0.80 0.06	0.77 0.07	
$\frac{\Sigma}{8}$	0.52	0.66	0.45	0.71	0.58	0.73	0.67	0.59	0.62

* All correlations are positive. The figures beneath the correlations give the probable errors. The averages are calculated from three positions.

TABLE 2*

CORRELATIONS OF GIRLS' CLASSES WITH GIRLS' CLASSES

	8 B	6 B	6 A	5 B	5 A	4 B	4A	3 B	3A
8 B		0.73 0.08	0.79 0.06	0.76 0.07	0.86 0.04	0.84 0.05	0.78 0.07	0.53 0.12	0.77 0.07
6 B	0.73 0.08		0.94 0.02	0.97 0.01	0.93 0.02	0.93 0.02	0.96 0.01	0.81 0.06	0.80 0.06
6 A	0.79 0.06	0.94 0.02		0.89 0.04	0.90 0.03	0.86 0.04	0.89 0.04	0.69 0.08	0.76 0.08
5 B	0.76 0.07	0.97 0.01	0.89 0.04		0.78 0.07	0.95 0.02	0.95 0.02	0.83 0.05	0.83 0.05
5 A	0.86 0.04	0.93 0.02	0.90 0.03	0.78 0.07		0.96 0.01	0.95 0.02	0.84 0.05	0.87 0.04
4 B	0.84 0.05	0.93 0.02	0.86 0.04	0.95 0.02	0.96 0.01		0.94 0.02	0.82 0.05	0.85 0.05
4 A	0.78 0.07	0.96 0.01	0.89 0.04	0.95 0.02	0.95 0.02	0.94 0.02		0.84 0.05	0.89 0.04
3 B	0.53 0.12	0.81 0.06	0.69 0.08	0.83 0.05	0.84 0.05	0.82 0.05	0.84 0.05		0.79 0.06
3 A	0.77 0.07	0.80 0.06	0.76 0.08	0.83 0.05	0.87 0.04	0.85 0.05	0.89 0.04	0.79 0.06	
$\frac{\Sigma}{8}$	0.76	0.88	0.84	0.87	0.89	0.89	0.90	0.77	0.82

* All correlations are positive. The figures beneath the correlations give the probable errors.

TABLE 3*

CORRELATIONS OF BOYS' CLASSES WITH GIRLS' CLASSES

	r.	p. e.
8 B	0.78	0.07
6 B	0.66	0.09
6 A	0.06	0.17
5 B	0.77	0.07
5 A	0.56	0.11
4 B	0.78	0.07
4 A	0.60	0.11
3 B	0.60	0.11
3 A	0.76	0.07
$\frac{\Sigma}{9}$	0.62	

* All correlations are positive.

The tables do not suggest any development in the aesthetic judgment between 3 A and 8 B. The question is whether there is a slight development in the judgment, a development so slight that it is covered as long as we consider only each class by itself. If we take the sum of the correlations of each class with its first and second neighbors for all the classes, and divide this sum by the number of correlations that enter into the sum, we obtain for the boys 0.620 and for the girls 0.895. If we determine in the same way the sum of the correlations of each class with its third and fourth neighbors and divide this sum by the number of correlations that enter into the sum, we obtain for the boys 0.620 and for the girls 0.883. Comparing these two pairs of numbers we find that the girls as well as the boys show a tendency to correlate higher with those classes that are near in grade than with those that are farther removed. The same tendency is brought out in the following way. We consider the averages of the correlations of each class with each class as represented in the last row of table 1 and table 2. We omit 8 B because the difference between 8 B and the following grade is greater than that between the others and their first neighbor. We take the four outer and the four inner grades together, forming the sum of 6 B, 6 A, 3 B, 3 A, on the one hand and that of 5 B, 5 A, 4 B, 4 A, on the other hand. The sum for the outer group is 2.32 for the boys and 3.31 for the girls. The inner group gives the sum 2.69 for the boys and 3.55 for the girls. The correlations for the inner groups are higher than those for the outer groups. There exist more classes that are near in grade for the inner groups than for the outer groups. The greatest difference between an outer class and the class it is correlated with is seven grades; the greatest difference between an inner class and the class it is correlated with is four grades. We thus find again the same tendency to higher correlation in the classes that are nearer neighbors than in those that are farther removed.

TABLE 4

CORRELATIONS OF GRAMMAR SCHOOL GROUPS WITH COLLEGE GROUPS

	Columbia		Barnard	
	r.	p. e.	r.	p. e.
8 B	+0.08	±0.16	—0.41	±0.14
6 B	—0.34	±0.15	—0.49	±0.13
6 A	+0.25	±0.16	—0.60	±0.12
5 B	—0.28	±0.16	—0.51	±0.12
5 A	+0.04	±0.17	—0.46	±0.12
4 B	—0.27	±0.16	—0.35	±0.15
4 A	+0.19	±0.16	—0.54	±0.12
3 B	—0.44	±0.14	—0.33	±0.15
3 A	—0.16	±0.16	—0.56	±0.12
$\frac{\Sigma}{9}$	—0.10	......	—0.47	......

The same experiment was carried on with a group of 20 Columbia students and a group of 22 Barnard students. The correlations between the ranking of the Columbia students and the boys' classes are given in table 4 under *Columbia;* the corresponding values for the Barnard students and the different girls' classes are shown in table 4 under *Barnard.* The table gives only negative correlations under *Barnard* and contains five negative and four positive correlations under *Columbia.* The correlations in the girls' group are high enough and the probable errors small enough to allow the conclusion that the selective principle in the Barnard group is the opposite of the selective principle in the grammar school groups. Not only is there no agreement between the taste of the College and that of the grammar school girls, but the Barnard group judges those pictures beautiful that the children consider least attractive, and the children prefer those pictures that the students reject in their aesthetic judgment. The same holds true with the groups of school boys and the Columbia College students, although the relation does not come out as clearly as with the girls. The average of the sum of all the correlations between Columbia and grammar school groups is —0.10. The corresponding figure for the girls' groups is —0.47. We are thus allowed to conclude:

3. *Whereas there is a high uniformity in the group taste of all the grammar school classes for boys, as well as for girls, there is an absolute break between the group taste of the grammar school classes on the one hand and the college on the other hand.*

A control experiment was introduced to determine whether the break between grammar school and college groups is caused by the age difference or by the difference of the social standing of the observers. A group of ten children from grade 2, 5, 6, 7, all belonging to families from the upper middle classes, were asked to rank the pictures in the same way as the children from the orphan asylum had done.[1] This group was compared with a group from the orphan asylum consisting of children from grade 3, 4, and 5. The correlation coefficient is +0.44 with a probable error ±0.14. This correlation is lower than all the correlations in table 2. Considering however that the control group consists of only ten observers, and that both groups which enter into the correlation are mixed groups, a correlation which is more than three times as high as its probable error seems high enough to deserve consideration. How much in such mixed groups the coefficient is influenced by chance is shown by the fact that the correlation of the control group with an unmixed group, class 5 A,—selected at random—is +0.52 with a probable error ±0.12.

The coefficient of the control group with the Barnard group is —0.25 with a probable error ±0.16. This correlation, like all the coefficients between the grammar school and the Barnard groups, is negative. It is lower than the other coefficients, but it nevertheless brings out quite clearly the fact that the taste of the two groups tends to go in opposite directions. The control experiment thus justifies the conclusion:

4. *The break between the grammar school children and the college students is not due to a difference in the social standing of the two groups but to the age difference.*

If we compare the correlations in the grammar school as given in table 1 and table 2, we notice that the figures are much higher for the girls than for the boys. This relation is best seen by considering only the figures for the sum of the correlations of each class with each other class as shown in the last row of the two tables. This sum is higher for each single class in the girls' table than in the boys' table. The lowest figure in the girls' table is higher than the highest in the boys' table. If we add these sums and divide them by the number of grades represented in the table (9), we obtain for the boys 0.614 and for the girls 0.847. The average deviation is 0.07 and 0.04 respectively. We thus conclude:

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[1] This experiment was conducted by Miss Mary C. Doremus.

5. *Different groups of girls agree more closely in their aesthetic judgment than groups of boys.*

It is interesting to note that the boys correlate just as high with the girls as with one another. The average correlation of the boys' groups with one another is 0.61; the average correlation for the corresponding classes of the two sexes is 0.62.

Another sex difference is brought out by the comparison of the standard deviations, σ, of the average positions of the pictures as given in table 5. The standard deviation is smaller in each grade for the boys than for the girls. The average sum of the deviations is 36.69 for the boys and 57.70 for the girls. The mean deviation of these deviations is 2.28 and 3.40 respectively. We thus conclude:

6. *The average positions of the pictures differ more from one another in groups of girls than in groups of boys.*

TABLE 5

STANDARD DEVIATIONS OF THE AVERAGE POSITIONS OF THE PICTURES

	Boys		Girls
8 B	33.1	<	65.9
6 B	40.9	<	56.0
6 A	34.3	<	62.5
5 B	37.0	<	60.3
5 A	35.1	<	57.9
4 B	35.5	<	53.8
4 A	36.9	<	54.6
3 B	42.2	<	53.2
3 A	35.2	<	56.1
$\frac{\Sigma}{9}$	36.7	<	57.7

A similar relationship is brought out by the comparison of that measure of variability which has been introduced by Hollingworth into the psychology of ranking, *i. e.*, the ratio M.V./P.[2] M.V. designates the average variability and P the total number of positions in the scale; M.V./P. thus designates the average variability divided by the number of positions. The values for this ratio are given in table 6. The ratio is higher in each grade for the boys than for the girls. The average for the boys is 0.221, that for the girls 0.180. The average deviation is 0.0038 for the boys and 0.009 for the girls. These facts allow the conclusion:

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[2] Hollingworth, H. L. "Judgments of the Comic," *Psychol. Rev.* vol. 18, 1911, p. 143. See also the same author's "Experimental Studies in Judgment," 1913, pp. 116-117.

7. Inside the group the girls agree more closely in their aesthetic judgment than the boys.[3]

The same relationship obtains again for the Columbia and Barnard group, M.V./P. being equal to 0.210 for the men students and 0.177 for the women students.

It is evident that there is a certain connection between the sixth and the seventh conclusion. If all the observers had exactly the same taste, so that each observer would choose that picture as first that all the other observers considered best, and if this held good for the second, third, and all the other choices as well, then the standard deviation for the average positions from their arithmetical mean would be a maximum and the M.V./P would be a minimum. In this case M.V./P would be zero and σ would be determined only by the number of pictures. On the other hand, if there were no agreement in the taste at all, we would obtain the same rank order as if such order were determined only by chance. If in this case a large enough number of observers is taken all the pictures will have the same average positions, and σ will be a minimum, namely zero. In this case the M.V./P will reach its maximum, which is for any number of pictures 0.250 as long as the number of positions is the same as the number of stimuli which have to be distributed over these positions.[4] In these two cases there is a one-to-one relation between σ and M.V./P. But this one-to-one relation subsists only in these extreme cases; in general there is a certain mathematical independence between these two values. Only some of the changes in the one factor influence the other factor; other changes are without effect. The fact that there is a certain mathematical independence proves that the conclusions 6 and 7 have each a meaning for itself. The same fact may be brought out by comparing the σ and the M.V./P values in the following way. If we arrange the σs of the boys according to their values beginning with the lowest and ending with the highest, we obtain the series: 8 B, 6 A, 5 A, 3 A, 4 B, 4 A, 5 B, 6 B, 3 B. *Arranging the M.V./P values in the opposite* way, beginning with the highest and ending with the lowest, we obtain the series: 8 B, 5 A, 6 A, 3 A, 4 B, 5 B, 4 A, 6 B, 3 B. The two series agree quite well but not so closely as they would in the case of a mathematical connection. We obtain the same result by comparing the corresponding values for the girls, as may be easily seen from table 5 and 6.

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[3] With regard to experiments giving smaller variability for girls than for boys compare William Stern, *Differentielle Psychologie*, 1911, pp. 276-278.

[4] If the number of observers is large enough each picture takes each position just as often as each other position so long as we have no selective principle but only a chance distribution. In case we have x positions, x pictures, and n observers (n being great enough) we obtain the same value for M.V./P. as if each picture takes each position only once. In this case each picture takes once the position 1, once the position 2, once the position 3, and so on up to position x-1 and finally position x. The arithmetical mean of all the x positions is $\frac{x\ (x+1)}{2x} = \frac{x+1}{2}$. The deviations of the single position from this average position are:

If instead of comparing the M.V./P's of the boys and the girls we consider the variability of the individual cards in the groups of boys and the groups of girls, we find another sex difference which, although not so pronounced as the three preceding sex differences, may be noticed easily in table 7. Since we are interested only in a comparative study of the two sexes, and since the number of stimuli as well as the number of positions is the same in all groups, the gross variability gives just as good an insight and is more exact than the ratio M.V./P, for small .differences might be easily covered by the division by the number of positions. The average devia-

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$$\left(\frac{x+1}{2}-1\right);\ \left(\frac{x+1}{2}-2\right);\ \left(\frac{x+1}{2}-3\right);\ \ldots\ldots\ \frac{1}{2};\ \left(\frac{x}{2}+1-\frac{x+1}{2}\right);$$

$$\left(\frac{x}{2}+2-\frac{x+1}{2}\right);\ \ldots\ldots\ \left(\frac{x}{2}+\frac{x}{2}-1-\frac{x+1}{2}\right);\ \left(\frac{x}{2}+\frac{x}{2}-\frac{x+1}{2}\right).$$

Adding these deviations we obtain $\frac{x^2}{4}$. The average of this sum gives $M.V. = \frac{x}{4}$ and $M.V./P = \frac{1}{4} = 0.25$. For odd numbers we obtain $M.V./P = \frac{x-1}{x}\,\frac{1}{4}$. The greater x, the nearer will M.V./P be to 0.25; for $x = 11$, it is already 0.99 times 0.25, $\lim\limits_{x=\infty} \frac{x-1}{4x} = \frac{1}{4} = 0.25$. The ratio M.V./P can never be greater than 0.25 nor smaller than 0.! Thus this relation holds for odd as well as for even numbers.

Table 6*

M. V./P of the Average Positions of the Pictures

	Boys		Girls
8 B	0.226	>	0.159
6 B	0.216	>	0.187
6 A	0.224	>	0.168
5 B	0.222	>	0.174
5 A	0.225	>	0.183
4 B	0.223	>	0.191
4 A	0.219	>	0.189
3 B	0.212	>	0.192
3 A	0.224	>	0.181
$\frac{\Sigma}{9}$	0.221	>	0.180

* All correlations are positive.

Table 7

Variability of the Better and Poorer Cards

	Boys			Girls		
	Good cards		Bad cards	Good cards		Bad cards
8 B	29.895	>	28.005	19.145	<	21.595
6 B	27.66	>	27.585	22.99	<	24.84
6 A	29.255	>	28.19	20.395	<	22.705
5 B	28.695	>	28.035	20.30	<	24.26
5 A	30.785	>	26.715	23.235	<	23.73
4 B	29.035	>	28.145	24.655	>	24.14
4 A	26.28	<	29.79	25.28	>	23.185
3 B	27.51	>	26.785	26.11	>	22.95
3 A	29.075	>	28.17	22.085	<	24.22
$\frac{\Sigma}{9}$	28.688	>	27.936	22.688	<	23.514

tions are divided up so that the eight better cards are taken together, and the eight poorer cards together. The sums of the average deviations of the better cards are given under "good cards," and the sums of the average deviations of the poorer cards are given under "bad cards." With the exception of one class, the figures for the boys are greater in the first column than in the second column. The boys agree more closely in their dislikes than in their likes. The opposite relation obtains with the girls. The girls agree more closely in their likes than in their dislikes, although this relation is not so clear as that with the boy's, three classes being different from the others. We are nevertheless allowed to conclude:

8. *Boys agree more in their dislikes than in their likes; girls agree more in their likes than in their dislikes.*

Comparing the Columbia and Barnard groups in the same way we see that here too the same relationship obtains. The figures for the Columbia group are in the good half 27.50 and in the poor half 26.37. The Barnard group gives 22.54 and 22.64 respectively. The same results were obtained—as far as girls are concerned—by Hollingworth with a group of ten girls in experiments on the judgment of the comic.[5] In his experiments on the judgments of persuasiveness, however, Hollingworth found the opposite relation with a group of twenty boys and a group of twenty girls.[6] Nor did the results agree in experiments which the present writer made with different groups and different material on the aesthetic judgment.[7]

If we combine, instead of the good and bad cards, the extreme and middle cards, taking together the cards that occupy the first, second, third, fourth, thirteenth, fourteenth, fifteenth, and sixteenth position on the one hand, and all the other cards on the other hand, we obtain results as represented in table 8. Column 1 and column 2 compare the

TABLE 8

VARIABILITY OF THE EXTREME AND MIDDLE CARDS

	Boys			Girls			Boys		Girls
	Extreme cards		Middle cards	*Extreme* cards		Middle cards	Difference		Difference
8 B	28.935	<	28.965	17.805	<	22.935	0.030	<	5.130
6 B	27.435	<	27.810	22.490	<	25.340	0.375	<	2.850
6 A	28.820	>	28.625	19.185	<	23.915	−0.195	<	4.730
5 B	26.715	<	30.015	18.710	<	25.850	3.300	<	7.140
5 A	28.225	<	29.275	20.775	<	26.190	1.050	<	5.415
4 B	27.265	<	29.915	23.280	<	25.515	2.650	>	2.235
4 A	26.620	<	29.450	21.405	<	27.060	2.830	<	5.655
3 B	26.515	<	27.780	23.195	<	25.865	1.265	<	2.670
3 A	28.020	<	29.225	22.785	<	23.520	1.205	>	0.735
$\frac{\Sigma}{9}$	27.617	<	29.007	21.070	<	25.132	1.390	<	4.062

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[5] *l. c.*, p. 141.

[6] Hollingworth, H. L. "Judgments of Persuasiveness." *Psychol. Rev.*, vol. 18, 1911, p. 256.

[7] "Correlation between Aesthetic and Recognition Value" to be published later.

extreme and middle values for the boys; column 3 and 4 show the corresponding values for the girls. With but one exception the variability is smaller in the extreme values than in the middle values.[8] Column 5 and 6 give the differences between these two groups for the boys and girls. With two exceptions these differences are smaller with the boys than with the girls. The table thus allows the conclusion:

9. *The difference in the variability between the extreme and middle pictures tends to be greater in groups of girls than in groups of boys.*

This relation is not found in the Barnard and Columbia group.

The fact that our experiments yield a considerable number of values for the M.V./P allows us to get a certain insight into this ratio. Before turning to our values, however, it is necessary to consider the literature about this problem. Hollingworth introduced the ratio M.V./P instead of the crude M.V. used by Wells in his experiments on the variability of individual judgment.[9] Wells in his comparison of the ranking with different material (preference of picture postals, difference in pairs of colors, and weight), comes to the conclusion: "It has appeared that in the first class the judgments of the individual cluster about a mean which is true for that individual only, and which varies from that of any other individual more than twice as much as its own judgments vary from it; that in the second class, with the colors, the variability of the successive judgments and those by different individuals markedly approached each other, but still preserved a significant difference; while in the third class, with the weights, we found that there might be even an excess of the individual variability over the 'social.' This comparison seems to afford, to a certain extent, a quantitative criterion of the subjective."[10]

Instead of using this ratio of the individual and social variability, the "Inter-Intra-Quotient,"[11] Hollingworth proposes the M.V./P: "This ratio M.V./P can then be used as a reliable index of the objective character of judgments and with a greater accuracy than the crude M.V. employed by Wells;"[12] and again: "The size of this ratio would become smaller as the material came to be selected so as to disclose more pronounced or more objectively measurable differences."[13]

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[8] The same results were obtained in five other group experiments with college students. Cf. "Correlations between Aesthetic and Recognition Value."

[9] This problem is only part of the general problem of the reduction of measures of variability for comparative purposes. We need not enter into this general problem since our interest centers only around the specific reduction by the number of positions.

[10] Wells, Frederic Lyman. "On the Variability of Individual Judgment." *Essays philosophical and psychological in honor of William James*, pp. 547-548.

[11] Stern, William. *l. c.*, p. 259.

Comparing different material which has as the only constant factor the basing of the judgment on the affective reaction to the stimulus, Hollingworth finds that with different groups of observers and with a widely ranging value for P, M.V./P is usually 0.20, and with high reliability.[14] In contrast to experiments where the judgment is based on the affective reaction to the stimulus Hollingworth observes that in experiments with more objectively measurable differences this ratio becomes smaller. Thus figures gained by Downey in experiments in the judgments of resemblance of penmanship yield, according to Hollingworth, M.V./P = 0.165, = 0.157, and = 0.168.[15] Wells' experiments with colors and weights give M.V./P = 0.086 and M.V./P = 0.136 respectively. In his later publication, however, Hollingworth suggests giving up the difference between *objective* and *subjective* judgment: "—judgments of intensity, etc., will vary as much as those of preference if the differences afforded by the material are sufficiently slight."[16] And again: "It is to be expected that various sets of material, of the same content but with differing degrees of difference between successive items would show the same difference in 'subjectivity' as those found with different kinds of material."[17] Our material supports this conclusion. We find values for the ratio M.V./P as high as 0.226 and as low as 0.159. Hollingworth's table representing ten different groups shows as the highest value 0.250 and as the lowest 0.180.[18] Taking Hollingworth's and our own material together, we thus find a variation between 0.159 and 0.250. These figures are taken only from experiments based on a "subjective" category. The more "objective" experiments on the resemblance of penmanship vary in this ratio from 0.157 to 0.168. The still more "objective" experiments of Wells show a ratio of 0.136 for weights and a ratio of 0.086

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[12] "Judgments on Comic," p. 145.

[13] *Ibid.*, p. 163.

[14] *Ibid.*, p. 145.

[15] *Ibid.*, p. 145.

[16] Hollingworth, H. L. "Experimental Studies in Judgment," 1913, pp. 116-117. We consider here only the one side of Hollingworth's analysis of the *subjective,* "the ratio of variability to series length."

[17] *Ibid.*, p. 144.

[18] *Ibid.*, p. 144.

for colors. Since Hollingworth's calculation makes the ranking of the weights appear more subjective than the ranking of the colors, and since this is in direct opposition to Wells' interpretation, we are justified in taking these two experiments in one class. Instead of taking Wells' ten observers together as Hollingworth did, I separate Wells' normal and abnormal observers, and thus obtain M.V./P = 0.155 for the abnormal and M.V./P = 0.107 for the normal group in the experiment with weights.[10] We thus obtain the following variations for our different groups:

1(based on affective tone....................0.250-0.159
2) resemblance of penmanship 0.168-0.157
3) color and weight 0.155-0.107

The first and second groups overlap one another to a great extent, and the second and third groups come very close to one another. In view of the fact that the ratio M.V./P can vary only between 0 and 0.250, the variations of the first group are very considerable. It seems unjustifiable to select one value like M.V./P = 0.200 as a representative value for the first group. The ratio M.V./P is a function not only of the category of the judgment but of the group that judges and of the material judged. We may obtain the same value for M.V./P with so-called subjective as with so-called objective judgment. The M.V./P is a measure for the strength of the selective principle in regard to a given group and a given material. We measure the strength of this selective principle by the position of the M.V./P in the series of values represented by all possible values between 0 and 0.25. In a case where the selective principle is absolute, the M.V./P will be zero; in a case where the selective principle is so weak that the distribution is due only to chance, the ratio will be 0.25. Thus in the case of the ten observers who arranged 35 advertisements according to their persuasiveness (see Hollingworth, Judgments on Comic, p. 144), the selective principle was so weak that it did not have any effect at all. The arrangement found there with ten observers was the same as a mathematical calculation would give. This example shows the importance of the M.V./P for the psychology of the ranking of advertisements. Only in case the M.V./P is smaller than 0.25, is the ranking of significance. Only in that case does there exist a principle of selection.

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[10] Wells. *l. c.*, p. 545.

RATE OF IMPROVEMENT OF THE FEEBLE-MINDED AS SHOWN BY STANDARDIZED EDUCATIONAL TESTS

By KATHARINE MURDOCH, Columbia University, Extension Department

This study is an attempt to compare the rate of progress made by feeble-minded, with that of normal children, of the same mental age, in elementary school subjects. The subjects of the experiment were twenty-one feeble-minded individuals, who are at the State Institution for the Feeble-minded, at Polk, Pa. The selection of individuals in the institution was made upon the basis of school grade. It was requested that all school pupils in Grades IV, V and VI (the highest grades represented in the institution), should take part. There were 37 pupils in these grades who took part in at least one of the tests the first year they were given. One year later, however, when the tests were repeated, only 21 of the original pupils were available. The others either had left the institution, or were ill, or were otherwise employed. The results of the 21 who completed the tests only, are given here. All of these pupils but one, were still in school when the second set of tests was given, the one having dropped out in June, 1917.

The first set of tests was given during the last week of 1916 and the first week of 1917. I have called this the 1917 set of tests. The second set of tests was given one year later and is called the 1918 set. Exactly the same tests were given both years, and the procedure of giving them, insofar as it was possible to make it so, was identical. All tests were given by the writer. The tests were as follows: (1) Those given individually: Terman Intelligence Test and Sylvester form board test. (2) Those given in groups: Trabue Completion test, Scale B; Thorndike Visual Vocabulary; Thorndike Reading, Scale Alpha 2; Woody, Addition, Subtraction, Multiplication and Division tests, all series B; Ayer's Spelling, list T; Woodworth and Wells, Easy Opposites and Adjective-noun tests. The pupils were also directed to write a composition entitled "Christmas at Polk," and to make a drawing, each, of a man and of a house. These latter were graded by the use of the Thorndike Handwriting Scale, the Hillegas Composition Scale and the Thorndike Drawing Scale.

The procedure of giving all the tests was exactly that indicated by the author of each test, and the scoring also followed their methods precisely. In case of the composition and drawing tests, no time limit was given and the final score was the median judgment of from four to seven competent judges, using the judgment scales referred to. The Handwriting judgment was based upon the sample obtained in the writing of the compositions.

The accompanying table indicates the average school grade of the pupils in 1917 (some were in a lower grade in arithmetic); and for both years, the pupil's chronological age, mental age (as revealed by the Terman test), and Intelligence Quotient. The class averages are given for each year, columns 4 and 5. In the case of the visual vocabulary (row 9) and Ayer's Spelling test (row 15), a class score was obtained according to the directions of the authors of these tests. The mean square deviation of the distributions for each year is found in columns 6 and 7; the correlations between the 1917 and 1918 series are presented in column 8, and the sigma of these correlations in column 9; the improvement (shown by the difference between the class scores for the two years), and the mean square error of the improvement are found in columns 10 and 11.

An examination of column 8 immediately introduces interesting speculation as to the reasons for the very low correlations found between the 1917 and 1918 tests. The writer surmises that this is largely due to the very unequal rate of development obtaining in the different individuals. An inspection of the range in chronological ages, varying between twelve and twenty-three years, suggests one possible cause for this, although it does not seem to hold true throughout, by any means, that the greatest gains are made by the younger children. Particularly interesting are the low correlations found in mental age, .68, and in I.Q., .79. The former perhaps may be partly explained by the fact that many individuals were over 16 years of age in 1917 and so would not be expected to improve mentally—whereas others were below this age, and, according to accepted belief, would be expected to show a mental gain in a year's time. The I.Q. correlation, however, is not subject to this explanation, being always the ratio of the mental age to the chronological age, unless this latter is over 16 years, in which case it is treated as though it were 16 years. According to Terman, the I.Q. is a constant factor in any individual, and the correlation found between the I.Q.'s of any group of individuals, obtained upon two occasions, with

COMPARISON OF RATE OF PROGRESS BETWEEN 21 FEEBLE-MINDED SUBJECTS AND *NORMAL CHILDREN*

1	2	3	4	5	6	7	8	9	10	11	12	13
2	Factors Measured	Units	Class 1917	Average 1918	σ of Class 1917	Average 1918	r	σ of r	Improvement[4]	σ of Improvement	Norms for	
											Grade 3	Grade 4
3	Grades	——	4.95	——	.724	——	——	——	——	——	3	4
4	Chron. Age (Range 12 yrs-23 yrs.)	Yrs. ms.	16–4	17–4	37 ms.	37 ms.	1	0	——	0	9.2	10.2
5	*Mental Age (Range 7-6 to 11-1)*	Yrs. ms.	9–2	10–0	13.28	17.43	.685	.1158	10 ms.	2.78	9.2	10.2
6	Intelligence Quotient	——	.6066	.6442	.0792	.088	.7945	.0805	.0376	.0006	1.0	1.0
7	Sylvester Form Board	Sec.	19.309	20.214	3.675	3.072	.5185	.1594	—.905	2.4557	18.7	16.7
8	Trabue Completion Test, Scale B	No. cor.	9.8	9.0	3.391	2.309	.5349	.1538	—.8	1.359	6.	8
9	Thorndike Visual Vocabulary	——	4.27	4.70	——	——	——	——	.43	——	——	——
10	Thorndike Reading Scale, Alpha 2	——	5.3019	5.459	.276	1.048	.5402	.1544	.1571	.582	5.25	5.75[1]
11	Woody, Addition	——	10.4	11.8	2.439	3.269	.663	.122	1.4	.544	9	11
12	Woody, Subtraction	——	8	8.3	3.116	2.059	.582	.144	.3	.554	6	8
13	Woody, *Multiplication*	——	7.52	9.04	3.381	2.935	.855	.587	.152	.386	3.5	7
14	Woody, Division	——	4.7	5.8	2.892	2.121	.677	.118	1.1	.466	3	5
15	Ayres, Spelling, List T	% cor.	40.9	41.7	29.42	30.43	.9733	.0118	.8	1.5617	50[2]	60[3]
16	Thorndike Handwriting Scale	——	9.78	9.66	1.966	1.761	.703	.011	.12	.314	9	10
17	Hillegas Composition Scale	——	30.65	31.65	11.803	14.23	.5398	.1585	1.0	2.8337	——	35[4]
18	Thorndike Drawing Scale	——	5.9	6.59	2.414	2.723	.848	.066	.69	.341	——	——
19	Woodworth-Wells, Easy Opp., (Time, 1′ 45″)	No. cor.	12.25	14.95	4.535	4.621	.809	.077	2.675	1.68	——	——
20	Woodworth-Wells, Adj. Nouns, (Time, 1′ 20″)	No. cor.	9.71	12.368	4.392	4.965	.911	.039	2.658	3.77	——	——

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[1] Norm for Grade 5. [2] Norm for Grade 5. [3] *Norm for Grade 6.* [4] *Norm for Grade 5 is 40.*

either a short or long interval of time elapsing, should theoretically be 1. I believe that the low correlation found in this study is due largely to the method prescribed, or at least allowed, by Terman, of scoring the tests. This method provides, in the testing of defectives, that when one test, at any age level is passed, the subject shall be allowed to try all tests at the next age level. But though Terman admits that the subject may be given opportunity to try at a higher age level, even if he has failed on all tests for the preceding year, he does not *insist upon this procedure,* and his own advice concerning the desirability of avoiding fatigue suggests to the examiner the advisability of stopping when all tests at any year have produced failure, particularly when he has already spent somewhat more than one hour upon the examination. The examinations reported here were made in that way, being discontinued when there was complete failure at any age level, and the method has evidently introduced an error. A close inspection of the individual records reveals the fact that the lowering of the I.Q. correlations here is due principally to the great improvement in mental ages made by five pupils, and in each case an examination of the original scores of these pupils has revealed that the great apparent gain is due to the fact that having passed one or more tests at certain age levels in 1918 which were failed utterly in 1917, the door was open for success at upper levels, and this success in the case of these five subjects was rather remarkable. The most marked illustration is that of a girl 13½ years old at the time of the first test with a mental age of 9, who, because of passing test 6 at year XII in 1918 (repeating five digits reversed), which test she had failed upon the previous year, was given further opportunity and succeeded with test 4 at XIV years (problems of fact), test 5 at XVI years (repeating 6 digits backward), and test 5 at XVIII years, or Superior Adult level (repeating seven digits backward), and advanced to a mental age of 11. The greatest advance in mental age, namely, from 8-2 to 10-6, was made by a boy 17 years old at the time of the first test.

The average mental age in 1917 was found to be 9 years and 2 months. Since the purpose of this study is to compare the rate of progress of these feeble-minded individuals with that of normal children of the same mental age, norms are given in our table, where such are known to the author, for normal children in the 3rd and 4th grades (columns 12 and 13). These norms represent a near approach to the normal performance of children of 9 years and 2 months, and those of children one year older. This fact was determined from a study by Kelly (reported in *Teacher's College Record,* Sept. 1917), of a completion test language scale, in which norms are given for both ages and grades, and it was inferred that the same relation between age and grade which was found by Kelly, would obtain, at least approximately, in all the tests reported in this article. (From Kelly's figures, by interpolation, we find more exactly, that children of 9 years and 2 months correspond to Grade 2.8+.) The author regrets that the actual progress of the same normal children, made in a year's time, could not have been used for comparison, instead of norms for two successive school grades, but in the absence of the desired data, the difference between these norms for grades 3 and 4 surely offers a reliable estimate of the improvement which would be made by a group of normal children of 9 years and 2 months, who would repeat the tests after an interval of one year.

The norms here reported for normal children in grades 3 and 4 are to be found in the original report of the tests given by their various authors in the case of the Terman Form Board, Trabue and Woody tests. In the Thorndike Reading test and the Hillegas Composition Scale, no norms are given below the fourth grades. In the Ayer's Spelling test, scores for the T list are not given below the fifth grade. The norms here given for the Hillegas Composition Scale are published in the *Teacher's College Record* of January, 1917, as tentative standard scores obtained from results in eleven city school systems. The handwriting norms are from an unpublished study made in the Department of Educational Administration at Teacher's College, from results obtained in eight cities. Many of the standard scores are in terms of medians. These medians, however, have been obtained from large groups in which the distribution probably followed the normal curve, so, for practical purposes, they are quite comparable to the averages used in the present study.

In every case of the school subjects in which comparison can be made between the feeble-minded and the normal, it will be seen that our group of feeble-minded children in 1917, did better than normal children of the same mental age, an interesting corroboration of Goddard's belief that feeble-minded can do more at certain tasks because they have had much more practice with them. This is true of the Language Completion test (row 8), of the four operations of arithmetic (rows 11-14), and of handwriting (row 16). The Thorndike Reading Scale norms (row 10) show that the feeble-minded in 1918 did better in this test than normal children of the same mental age (4th grade). In Composition (row 17), however, the reverse is true, normal fourth graders outranking our group in 1918, by a score of 35 to 31.65. In many of the tests we seem to be at, or near, a point where the "overtaking" is taking place, for we must now turn to our original problem, which was to compare the rate of improvement of the two groups.

Here our data seem all to point unreservedly to one conclusion, which is that the rate of learning of feeble-minded children in these elementary school subjects is less than the rate of normal children at the same mental level. The form board test (in which the score is in terms of time taken to put the blocks in position), the language completion test, all the arithmetic tests and handwriting all give the same results. The same is furnished by the reading scale (row 10), if comparison is made between the amount of improvement made in one year by normal children starting in the fourth grade. The fifth grade norm given by Thorndike is 5.75, which shows a gain of .50 in one year. The feeble-minded children gained only .16 in one year. The same comparison between the Fourth and Fifth Grades in Composition (4th Grade 35, 5th Grade 40, row 17), shows a much larger gain made by normal than by feeble-minded children in one year's time. The same thing can be seen by studying Ayers' norms for Spelling, row 15. Improvement in any of his spelling lists, from one grade to the next, is much greater than the gain made by our group in the T test.

One possible explanation of these results might be that the instruction of the feeble-minded group was poor, and that the time they spent in school was less than is the case with normal children. I believe, from consulting with the Superintendent of the Institution, that the second of these conditions does exist, but that, on the other hand, the instruction is given in small classes and by competent teachers, and can therefore be supposed to be above the average of schooling in general. This fact would probably offset the other, that the length of time spent in school each day is slightly less than in the case of most children.

The most probable explanation for our results seems to lie in the subjects themselves. Common sense has long been of the opinion that feeble-minded children learned less quickly than normal children at their same mental level, and our results would seem to add little to our knowledge, were it not for the findings of Woodrow, reported in the *Journal of Educational Psychology*, February, 1917. Woodrow trained groups of feeble-minded and of normal children of the same mental age, in a geometrical form sorting test, and found that the rate of improvement for the two groups was similar. These results, Woodrow thinks, "strongly suggest that it is not inability to learn which characterizes incapacity for mental development, but inability to grow. . . ." The results of the present study seem to indicate that if the term "learning" can be properly applied to improvement in the elementary school subjects, that "inability to learn"—at least at the average rate—does then characterize incapacity for mental development. The discrepancy between Woodrow's results and those reported here seems to the present writer to be due to a difference in the test material used. Woodrow's test *was one of pure habit formation, in which little analysis or* abstract activity was required. Since it is in just this power to respond by partial activity or analysis that the feeble-minded are below the normal, in the opinion of many writers, one would naturally expect to find improvement in functions demanding this ability to be less than in cases of concrete habit formation, and this is what has been found in this investigation.

As for so-called mental age, whatever this well-known term may mean, according to the results of the present study, it does *not* mean either ability to do the same grade of work as that done by others of the same mental age, in most of the elementary school subjects; nor does it mean ability to make *the same rate of progress in these same school subjects.*

A GROUP POINT SCALE FOR MEASURING GENERAL INTELLIGENCE, WITH FIRST RESULTS FROM 1,100 SCHOOL CHILDREN[1]

By S. L. Pressey and L. W. Pressey

I. Origin and Plan of the Scale

In the autumn of 1917 the Departments of Psychology and Sociology of Indiana University undertook to make a survey of a certain county "X" in the southern part of Indiana to determine the number of mental defectives (feebleminded, epileptic, insane) in the county. The writers were to have charge of the mental testing done in connection with the survey. They were already committed to psychological research dealing primarily with the problem of selecting gifted children in the public schools for special classes, extra promotion, or other special educational treatment. But a combination of the two problems, where an educational survey should run parallel with a careful sociological study of the community, promised results of unusual interest. The reliability and significance of the results obtained in the schools might on the one hand be much more exactly determined if these results could be correlated with adequate sociological data regarding the individuals and localities studied. The educational study (which must naturally cover more cases than merely those suspected of mental defect) would on the other hand give a much wider basis for estimating the total mental make-up of the community than would otherwise be gained.

As a matter of fact the writers hoped to test *all* the school children of the county. Plans for research in the educational field already made had centered around the development of group tests of intelligence. As a method of first selection in a search for mentally defective or mentally superior children Yerkes, Pintner, and Whipple had already pointed out the value of the method;[2] group tests were being suggested for a similar purpose in the army. But it seemed likely that group test ratings might be of considerable further practical educational value, because of the growing tendency to divide classes into sections according to ability. Particularly in the "Junior High Schools" there is much interest in any plan which will readily give some measurement of the general intelligence of all the children in a class as an aid in making such divisions.

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[1] The present article from the Psychological Laboratory of Indiana University reports part of the work being done as a result of the creation of a special research position in the department of psychology, the holder (Dr. Pressey) devoting all of his time to research. Special acknowledgments should, therefore, be made to President W. L. Bryan and the University for the unusual opportunities provided; to Professor W. F. Book, director of the Laboratory, for suggesting the problem and arranging for research in this special field of work; also for helpful suggestions in organizing and carrying on the research of the year. The Group Scale, here briefly described, is only part of a larger study, carried out under his general direction. The results from this larger study will be published as soon as the data can be tabulated and carefully studied.

The writers were, however, most interested in a third problem of much practical and theoretical importance which also called for a group scale for measuring general intelligence. It has been generally acknowledged by workers with tests of intelligence—from Binet on—that norms vary widely according to the sociological status from which children come.[3] There is a very considerable body of evidence to indicate that we need racial norms.[4] Children coming from homes where English is not spoken rate definitely lower than children whose home language is English, (see Yerkes, Bridges, and Hardwick, *ibid.*, pp. 64-8). This is only one of the many special factors which an examiner may have to deal with.[5] It is, therefore, obvious that the problem of the exceptional child, and in general the problem of adapting school training to the abilities of individual pupils, varies according to the variations in ability in a given school or locality. The child who would be exceptional in one neighborhood might be near the average in another. It is much more important that allowances for differences in ability be made in a school showing wide range in ability,—a school containing a number of very dull and very bright pupils,—than in a school where the range of distribution is narrow. Some measurement giving the average and distribution of abilities in the school as a whole should thus be the first step in any attempt to adapt the school organization to differences in ability found among children.

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[2] Yerkes in a paper delivered at the annual meeting of the Massachusetts Society for Mental Hygiene, Nov. 1917, Pintner "The Mentality of the Dependent Child, together with a Plan for the Mental Survey of an Institution," *Journal of Educational Psychology*, vol. 8, 1917, pp. 220-238, and Whipple in a report at the meetings of the American Psychological Association, New York, 1916.

[3] W. Stern, *The Psychological Methods of Testing General Intelligence*, pp. 50-57; Terman, *The Measurement of Intelligence*, pp. 114-18; Yerkes, Bridges, and Hardwick, *A Point Scale for Measuring Mental Ability*, pp. 73-83.

[4] E. D. Rowe, Five Hundred Forty-Seven White and Two Hundred Sixty-Eight Indian Children, tested by the Binet-Simon Tests, *Ped. Sem.*, vol. 21, 1914, pp. 454-69; Redfern H. Loades and S. G. Rich, Binet Tests on South African Natives-Zulus, *Ped. Sem.*, vol. 24, 1917, pp. 373-83; W. H. Pyle, The Mind of the Negro Child, *School and Society*, vol. 1, 1915, pp. 357-60; B. A. Phillips, The Binet Tests Applied to Colored Children, *Psychological Clinic*, vol. 8, 1914, pp. 190-96; A. C. Strong, Three Hundred Fifty White and Colored Children Measured by the Binet-Simon Measuring Scale of Intelligence, *Ped. Sem.*, vol. 20, 1913, pp. 485-515; Dagny Sunne, A Comparative Study of White and Negro Children, *Journal of Applied Psychology*, vol. 1, 1917.

[5] The writers are convinced, for instance, that on no one of the standard scales of intelligence should country children be judged by the same standards as city children. There are numerous elements in these scales which are distinctly urban. Country children frequently show also a different attitude toward the examination. They are less

But now the sociological aspect of the problem appears. If the worker with mental tests must take account of sociological facts, his results should be useful as sociological data. The average level of intelligence of the school children of a community is the best single indication of the general intellectual level of the community as a whole. Facts regarding the distribution of abilities in the school population should give information of great value as to the homogeneity, make-up, and status of the total population of the locality, information contributing directly to our understanding of such phenomena as pauperism, criminality, economic and social status.[6]

Whatever might be the case so far as the educational problems were concerned, at least for such wholesale testing of entire communities as we have just suggested a group scale seems clearly necessary. The writers felt that no set of tests available was satisfactory for the purpose in hand. They desired, in the first place, a scale composed of tests which should be applicable over a wide range of ages—if possible, from the second grade through high school—and which should be highly differential of general intelligence throughout this

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used to strangers and express themselves less readily. The group examination has been of great use in the country schools just because the country children are often handicapped in such ways, if examined individually, but respond readily in the group. The writers feel that ratings of intelligence, by both individual *and* group method, are necessary for an adequate measurement of a child's ability.

[6] In fact the community survey by means of mental tests promises to be one of the most interesting and valuable of the recent developments in the field of mental testing. Its possibilities, in connection with social, economic, and also racial problems appeals to the imagination as does almost no other branch of the science. See, for example, Pintner, "A Mental Survey of the School Population of a Village", *School and Society*, vol. 5, 1917, pp. 597-600; D. G. Patterson, "Mental Survey of the School Population of A Kansas Town" *School and Society*, vol. 7, 1918, pp. 84-8.

range. They felt, in the second place, that where group tests were to be given to younger children special methods for obtaining and controlling the attention of the children were a necessity if the ratings were, particularly in individual cases, to be reasonably reliable. They realized, in the third place, that for such extensive practical work and research the tests must be very carefully planned and arranged for convenience and economy of time and effort in scoring and also for ready handling of the data in research. One of the chief aims of the psychological study was to obtain a large amount of data for the study, by test, of sex, race, environmental and other differences.

An attempt to develop a set of tests which should meet these three requirements has resulted in what is here called the "Group Point Scale" for measuring general intelligence. The ten tests of the scale were selected from thirty tests experimented with. The writers made themselves thoroughly familiar, by means of Binet ratings, teachers' estimates, and school histories, with the abilities of the children in the third and fifth grades of the Bloomington, Indiana, schools, and with a group of eighth grade children and High School Sophomores. It was required of each test, in the first place, that the beginning be easy enough and the directions clear enough so that nine-tenths of the 3B children would make some score, and that the end of the test should be hard enough so that no one of the high school sophomores (averaging sixteen years old) would make a perfect score. The tests were then selected according to their ability to differentiate, at each grade, the bright and the dull children.

Tests which would fulfil to a fair degree the first requirement—range of applicability—were thus selected. The most original features of the scale have to do with the attempt to meet the second requirement, of careful adaptation in the nature of the tests, and in flexibility and ease in control of the class, for work with school children. The tests have, the writers believe, in an unusual degree an intrinsic interest and appeal for children. There is, within the limits set by the general plan and organization of the scale, great variety in the form of the tests, the content, and the method of giving. The directions are such that the children take part, with questions and answers from the class, in the explanations of the examples preceding most of the tests. There is an alternation of tests in which the examiner gives the test item by item with those where the task is set and the child is left to himself to complete it (tests 2, 4, 6, 8, 10). A scale made up wholly of tests of the latter sort, is, the writers feel, unsatisfactory for examination of at least the younger school children, by the group method.[7] Group tests, when given to school children, very often have a stiffness and artificiality which seriously modifies the results, particularly when (as with intelligence tests) the individual ratings as well as the class averages are to be used. To an observer the present examination is much like an ordinary class exercise so far as easy relation of examiner to class and friendly co-operation between the two is concerned. Much more is, of course, demanded of an examiner in the way of personality, ready control of the children, and thorough grasp of the directions. But good examining always requires skill—it might be well if more stress were put upon this fact, and less energy expended in trying to make tests "fool-proof." The effort of the writers has been to arrange an examination such that the skilful examiner might develop something of the easy control of his class that a good Binet worker has of his single patient. He must be able to reach out to this individual or that, stimulate interest and rivalry, supply a touch of humor now and then, and swing the class as a whole into a united effort where not only the class as a whole, but each individual in it, shall be in rapport with the examiner and stimulated to do his utmost.

The results of the effort to meet the third requirement, of convenience and economy of time in both practical work and research, may be more briefly indicated. The clerical labor of the child in taking the examination is slight; only three tests call for much writing, and then only for single words, mostly monosyllables. Each item on each test can be scored as unequivocally right or wrong; the scoring is easy and of a routine nature. The writers use a stencil, which is placed over the blank, in scoring. The stencil has openings through which the child's answers appear, with the correct answer written beside the opening on the stencil. With this device it is possible for a good stenographer to score the entire record of one pupil in about two minutes. Finally, the total organization of the scale has been carefully considered with reference to con-

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[7] This alternation is further of much interest, in that variations in performance under these two conditions give a measure of instability. The impulsive, nervous, high strung child (every clinical psychologist is familiar with the type) does fairly well if the examiner keeps the test constantly before him by presenting it bit by bit, but wanders quickly to other matters if left by himself with a problem. A statement of "irregularity" gives a measure of this factor. See S. L. Pressey, Distinctive Features in Psychological Test Measurements Made upon Dementia Præcox and Chronic Alcoholic Patients, *Journal of Abnormal Psychology*, vol. 12, 1917, pp. 130-139.

File.................................. **Schedule D**

INDIANA UNIVERSITY

MENTAL SURVEY — GROUP STUDY

Name..................................Age............Birthday...................Grade..................
Teacher...................................School...............Place...............State..................
Date..............*Score*...............*Percentile*...............*M.A.*...............*Irreg.*.............

I. Rote Memory.

1......................
2......................
3......................
4......................
5......................
6......................
7......................
8......................
9......................
10......................
11......................
12......................
13......................
14......................
15......................
16......................
17......................
18......................
19......................
20......................

II. Logical Selection.

DOG: ears, collar, nose.
Examples: BOOK: table, pages, shelf, printing.
CHAIR: arm, cushion, legs, rockers, seat.

1. CAT—fur, house, milk, claws.
2. TREE—apples, branches, acorns, roots, flowers.
3. SPELLING—book, writing, pencil, words, margin, letters.
4. SCHOOL—blackboard, teacher, window, pen, bell, school-house, pupils.
5. STORE—counter, clerk, cash register, advertisements, goods, boxes, stove.
6. BUILDING—windows, wood, chimney, wall, shingle, roof, stairs, shed.
7. DEBT—mortgage, creditor, money, lawyer, collector, debtor, bankruptcy.
8. SICKNESS—lameness, death, weakness, hospital, nurse, discomfort, doctor.
9. GOVERNMENT—capitol, consul, navy, freedom, King, senate, cannon, tax.
10. FRIENDSHIP—adoration, liking, lover, obedience, imitation, helpfulness, worship, girl.

III. Arithmetic.

1......................
2......................
3......................
4......................
5......................
6......................
7......................
8......................
9......................
10......................
11......................
12......................
13......................
14......................
15......................
16......................
17......................
18......................
19......................
20......................

IV. Opposites. Examples: poor—rich.

quick........................

hot........................

1. bad 1..............................
2. short 2..............................
3. little 3..............................
4. black 4..............................
5. high, 5..............................
6. light 6..............................
7. day 7..............................
8. thick 8..............................
9. few 9..............................
10. peace 10..............................
11. from 11..............................
12. top 12..............................
13. apart 13..............................
14. less 14..............................
15. never 15..............................
16. bless 16..............................
17. country 17..............................
18. past 18..............................
19. motion 19..............................
20. if 20..............................

V. Logical Memory.

1........................
2........................
3........................
4........................
5........................
6........................
7........................
8........................
9........................
10........................
11........................
12........................
13........................
14........................
15........................
16........................
17........................
18........................
19........................
20........................

VI. Word Completion. Example: c....w.

1. c....t
2. b....by
3. tra....n
4. b....sket
5. b....n....na
6. tel....g....am
7. sw....at....r
8. eng....n....
9. a....it....me....ic
10. c....len....ar.
11. a....t....mo....i....e
12. g....v....rn....e....t
13. p....tat....
14. d....cta....i....n
15. pa....ri....t....sm
16. org....ni....a....i....n
17. c....lu....n
18. t....a....h....r
19. f....e....d.... ....
20. s.... ....et....i....g

VII. Moral Classification. Examples: marking, desks, giving, smoking, begging.

Whispering, stealing, charity, drunkenness, passing notes, kindness, sickness, gambling, tardiness, friendliness, extravagance, swindling, being noisy, benevolence, disobedience, forgery, justice, dissipation, graft, gluttony.

VIII. Dissected Sentences. Examples: See a I man.
knife the sharp is
cat dogs the after ran two

1. the cat see.
2. trees pine tall are.
3. boy was the sick.
4. I not do to like go school to.
5. me give my straw hat.
6. all know big boys how skate to.
7. their soldiers for fight country.
8. in the he brightest is boy class our.
9. teacher me gave a pencil my.
10. brother is my than I older.
11. asked me way I girl the to show the.
12. boy stone the who threw ran the fence the behind.
13. dash brother broke for my the yard fifty record the.
14. man whom the saw is you uncle my.
15. river the John to swim tried was straight but across carried down-stream.
16. the boy in is class only our old youngest ten years.
17. you me to direct office of will the principal the?
18. watch the man stole is jail who the in.
19. who the sing during birds so summer the flown the sweetly to have south.
20. boy gold who highest watch which beautiful prize jumps the get the will is a.

IX. Practical Information. Examples:

man		train
cow		mule
hen	X	horse
dog		bicycle
cat		steamboat

1.	2.	3.	4.	5.
water	string	milk	drop the handkerchief	Fourth of July
wood	chalk	salt	football	Washington's Birthday
cork	steel	bread	baseball	Memorial Day
sand	glass	fish	hide and seek	Thanksgiving Day
iron	pencil	meat	checkers	Labor Day

6.	7.	8.	9.	10.
scissors	policeman	bill	small pox	weaver
chisel	sheriff	coins	scarlet fever	cabinet-maker
plane	senator	check	measles	riveter
saw	mayor	draft	tuberculosis	typesetter
knife	representative	stamps	diphtheria	coal-picker

X. Analogies.

girl—woman: boy—man

Examples: sun—day: moon..............................

good—bad: big..............................

1. woman—girl: man..................
2. kitten—cat: puppy..................
3. sky—blue: grass..................
4. fire—warm: snow..................
5. winter—autumn: summer.....
6. horse—trot: fish..................
7. long—short: thick..................
8. train—land: boat..................
9. oyster—shell: banana.............
10. mother—daughter: father......
11. hill—valley: high..................
12. arm—elbow: leg..................
13. truth—falsehood: straight line..................
14. like—friend: hate..................
15. teach—learn: teacher..............
16. known—unknown: past........
17. little—small: ancient..............
18. water—pipe: electricity..........
19. age—youth: autumn..............
20. failure—laziness: success........

QUESTIONS

venience in dealing with data. There are ten tests, each one contains twenty items, or points. The value of this plan—for tabulation, or analytical study by test, is obvious.

II. The Tests

Further details as to the exact nature of the examination can best be gathered from the facsimile blank and folder of directions given below.

General Technique

The examination ordinarily takes 45 minutes, but with third grade children it may run over an hour. Part of the extra time with the younger children goes into supervising the writing of name of teacher and school, date, and so on. With young children it is also necessary to make clear, by holding up a sample blank and pointing to the place, where each test is to be answered. But most of the time is spent in making certain that the examples are understood. It has been found most satisfactory to permit no questioning on the part of the children except on the examples, nor should there be any repetitions of directions except in explaining the examples, which should not be left till the class shows a unanimous understanding of them.

The directions (except, as just mentioned, in making clear the examples) should be given verbatim as printed. The words of the rote memory test should be read at a rate of about two words per second. The exact time consumed by each individual item of the *arithmetic, logical memory,* and *practical information* tests cannot be given. It has been intended that these should be "work-limit" rather than "time-limit" tests, that time should be given for all except the very slow pupils to do all they can do. The examiner should, therefore, watch his class, and be careful not to travel too fast for the children. When working with the younger pupils the extra time they require in writing must be allowed for. Some evidence of the way the timing of these tests has been handled by the writers may be gained from the fact that the times have run from three to five minutes each for the rote memory and practical information tests, and six to eight minutes for the arithmetic test, with two minutes for the questions of logical memory. With third grade children the last five arithmetic problems may be omitted. For all others the tests should be given entire, whatever the grade.

Directions to Pupils

All write your name please at the top of the page where it says "name", and your age where it says "age", then your birthday—month and day of the month—then your grade. On the second line write the name of your teacher where it says "teacher", then the name of the school (district, if country), place, (city or township), and the state, (Indiana). On the third line write the date (give date).

Now I am going to give you some tests. Please do your best, do your own work, and do *not* pay any attention to what those around you are doing.

I. Rote Memory

Just below where you have been writing are twenty empty lines. Do you all see them? (Show place on blank). I am going to read you some lists of words, so listen very carefully as I shall read each one but once. Do not write while I am reading; wait till I get through and then write the word I tell you to write.

1. This is the first list of words: *hat*, boy. Write on the first line the word that came after hat.
2. This is the second list: *mouse*, chair. Write on the second line the word that came after mouse.
3. This is the third list: cat, *baby*, cow. Write on the third line the word that came after baby, etc., for each line. (Repeat statement for each of the following lists.)
4. *paper*, watch, ink.
5. *horse*, stone, window.

This is the sixth list: Write the answer to this question on the sixth line.

6. ground, milk, *desk*, hand.
7. *lamp*, kitten, tree, girl.
8. ruler, *clock*, table, box.
9. *street*, glass, cloud, shelf.
10. spoon, print, red, *milk*, green.

This is the eleventh list: Write the answer to this question on the eleventh line.

11. chalk, *man*, bag, book, sister.
12. mother, chair, *think*, best, rain.
13. *run*, dark, hard, pen, flower.
14. ball, *shoes*, sleep, sick, bright.
15. light, past, *bed*, dog, match, coat.

This is the sixteenth list: Write the answer to this question on the sixteenth line.

16. swim, dull, plow, *sky*, ship, dress.
17. *ring*, foot, jump, snow, flat, child.
18. point, noise, *cook*, river, dead, long.
19. pencil, *quick*, house, hill, run, store.
20. grass, rain, *woman*, cloth, see, true, warm.

II. Logical Selection. (Time 3 minutes.)

Just below where you have been writing are some words in big letters. Each one is followed by a list of other words in small letters. Look at the examples: the first word in big letters is "dog." What two things in the list following is a dog never without? (Have class give answer)........Those two words are underlined. Look at the second example. What two things in the list following "book" is a book never without? (Class answers question)........Put a line under each of these words, just as there is a line under "ears" and under "nose" in the first example. Now look at the third example. What two things in the list following "chair" is a chair never without?........Put a line under each of these two words, just as you put a line under "pages" and under "printing" in the second example. Now hold up your pencils like this so you will all start together. In each of the ten lists, just below, put lines under the two words which the word in large letters, at the head of the list, is never without, exactly as you put lines under "pages" and "printing" and "legs" and "seat" in the two examples. And one thing more: do not underline more than *two* words in any list.

III. Arithmetic.

Just below where you have been working you will see a number of lines numbered from 1 to 20. On these lines I want you to write the answers to the questions I am going to read. Do the questions *in your head.* If you miss an answer leave the line blank.

1. On the first line write the answer to this question: If you had 5 eggs, and broke two, how many would you have left?

2. On the second line write the answer to this question: If you had 10 apples, and gave 1 to your mother and 1 to your father, how many would you have left?

3. If you had 25 marbles and lost 4, how many would you have left?

4. If you had 25 sticks of candy, and you gave 5 to your sister and 6 to your brother, how many would you have left?

5. If you had 25 rabbits, and 4 of them were killed and 8 more ran away, how many would be left?

On the sixth line write the answer to this question:

6. If you had 25c and bought 5 papers at 2c each, how much would you have left?

7. If you had 15c and bought three blocks of paper at 3c each, how much would you have left?

8. If you had 25c and you bought two handkerchiefs at 10c each, and a pad of paper at 3c, how much would you have left?

9. If you had 25c, and you bought 2 erasers at 3c each and a bottle of ink at 5c; how much would you have left?

10. If you had 50c, and bought a half dozen eggs at 60c a dozen, how much would you have left?

On the eleventh line write the answer to this question:

11. If your father gave you 30c, and your mother gave you ½ as much, and you spent a third of what you had in all, how much would you spend?

12. If you could walk a mile in 20 minutes, how many miles could you walk in 2 hours and a half?

13. If you spent 5c a day for a week, and then spent twice as much each day of the next week, how much would you spend in all?

14. If you had 30 books, and you gave away one-third of them and then lost 3, how many would you have left?

15. If you rode 5 miles and a half in a taxi cab, at 50c a mile, how much money would you spend?

On the sixteenth line write the answer to this question:

16. If you had a dollar, and you went down town spending 5c on the way down, and twice as much on the way back, and bought 2c

stamps for twelve letters while you were there, how much would you have left?

17. If you bought 3½ lb. of sugar at 10c a lb., and a gallon of milk at 12c a qt., how much would you spent?

18. If you could copy a list of 100 words in 5 minutes, how many words could you copy if you worked 40 minutes a day for 4 days?

19. If you had 50c and you bought 5 pints of milk at 12c a qt., a half lb. of candy at 10c a lb. and a loaf of bread at 9c, how much would you have left?

20. Suppose your family has to have 5 loaves of bread each week. If bread should go up from 7c to 10c a loaf how much less butter, at 30c a lb. would you have to use, and still pay the same for butter and bread?

IV. Opposites. (Time 3 minutes.)

Turn over the page; at the top of the page there is a list of 20 words, with a blank line at the side of each one. Look at the first example, the word is "poor." What is the opposite of "poor;" if you are not poor, what are you? (Have the class answer)........Look at the second example, the word is "quick." If you are not quick what are you? (Class answers question)........Write the word "slow" on the line beside "quick," because slow is the opposite of quick. Look at the third example, the word is "hot." What is the opposite of hot? (Class answers question)........Write the word "cold" on the line beside "hot," because cold is the opposite of hot. Now write the opposites of all the other words in this list on the lines beside them. On the line numbered 1 write the opposite of "bad," on the line numbered 2 write the opposite of short, and so on for the twenty words. If you come to one you do not know, skip it and go on.

V. Logical Memory.

This time, put your pencils down. I am going to read you a newspaper article and I want you to listen very carefully, for I shall read it only once and then shall ask you several questions about it. You are to write the answers to the questions on the twenty empty lines just below where you have been working. This is the article:

"East Chicago, January 17. A fire on Washington Street, early this morning, destroyed Smith's grocery store, a barn and two dwelling houses near. The loss was about $12,000 and was partly covered by insurance. Six gallons of kerosene in the rear of the store burned fiercely, and made the fire hard to put out, because throwing on water only spread the flames. Mr. Smith lived over the store with his wife, two sons, and a daughter. The youngest, Mary, five years old, was made unconscious by the smoke and was rescued by a neighbor with some difficulty. The younger son, Harry, seven years old, helped his father in removing some of the goods from the burning store. Sparks, carried by a strong west wind, spread the fire to the adjoining buildings. Some think the fire was accidental, but the cash drawer was found open and empty, so the fire was probably set to conceal a robbery."

Now answer these questions with just one word—yes or no, or a name or a number. Write the answer to this question on the first line:

1. Were the buildings insured?
2. Was the oldest child overcome by smoke?
3. Was she rescued by her father?

4. How many children were there in all?
5. Was Harry five or ten years old?
Write the answer to this question on the sixth line:
6. How many dwelling houses were burned?
7. Was the kerosene the cause of the fire?
8. How many gallons of kerosene were there?
9. Was the wind blowing from the north?
10. What was the youngest child's name?
Write the answer to this question on the eleventh line:
11. Did Mr. Smith live in one of the adjoining houses?
12. Was the fire in the summer time?
13. Was Mrs. Smith badly burned?
14. On what street was the store?
15. On what day of the month did the fire take place?
Write the answer to this question on the sixteenth line:
16. Did the fire burn three or five buildings?
17. How great was the loss?
18. What part of Chicago was the fire in?
19. How much money was found in the cash drawer?
20. Did the fire burn down a drug store?

VI. Word Completion. (Time 3 minutes.)

At the bottom of the page you will see a list of words: wherever you see a line in these twenty words it means that a letter has been left out. And I want you to fill in these letters. Now all start.

VII. Moral Classification. (Time 1 minute for each group.)

At the very top of the next page you will see three lines of words; *look at the examples. They read "marking desks, giving, smoking,* begging." Do you all see them? What words of the examples mean something which you must not do in the school-room? (If "smoking" is given by the class say: "Why, you wouldn't be likely to smoke *in* the school-room anyhow, would you?") That word has a number "1" *under it. What word in the example means being good to other* people? (Class answers)........Put a number "2" under that, in the same way that there is a number 1 under "marking desks" in the first example. What word in the example means something that will hurt yourself? (Class answers)........Put a number "3" under *that. What word in the example means getting something unfairly* from some one else? (Class answers)........Put a number "4" under that. Now pencils up.

1. Go through the list (it begins with "whispering") and put a number "1" under each word which means something that it is wrong *to do in the school-room, in just the way that there is a number "1"* under "marking desks" in the example.

2. Pencils up. Now go through the list again and put a number "2" under every word which means being good to other people, in just the way that you put a number "2" under "giving" in the example. *And one thing more, do not put more than one number under any* word.

3. Pencils up. Now go through the list a third time and put a number "3" under every word which means something which hurts yourself, is bad for yourself, just as you put a number "3" under *"smoking" in the example. And again, do not put more than one* number under any word.

4. Pencils up. Now go through the list a fourth time and put a

number "4" under each word which means getting something unfairly from some one else, in just the same way that you put a number "4" under "begging" in the example. And once more, do *not* put more than one number under any word.

VIII. Dissected Sentences. (Time 5 minutes.)

Now pencils up—all stop. Look at the examples just below where you have been working. The first example is "See a I man." That does not make sense, does it?........How should it read? (Class answers)........What *should* be the first word? (Class answers) ....That has a line under it. What *should* be the last word? (Class answers)........That has two lines under it. Look at the second example. How should it read? (Class answers)........What should be the first word? (Class answers)........Put a line under it in just the way that there is a line under "I" in the first example. What should be the last word? Put two lines under that in just the way that there are two lines under "man" in the first example. Now look at the third example; what ought to be the first word if the sentence is to make sense? (Class answers)........Put a line under it. What ought to be the last word if the sentence is to mean anything? (Class answers)........Put two lines under that. You see the sentence should read "Two dogs ran after the cat." Now go through the 20 sentences just below and in each one put one line under what should be the first word, and two lines under what should be the last word, if the sentence is to make sense, just as you put lines under "the" and "sharp," and "two" and "cat," in the examples.

IX. Practical Information.

Turn over the page. At the top are two examples. The first one reads "man, cow, hen, dog, cat." Of those five animals, which one usually lives the longest? (Class answers)........That has a line *under* it. Which one usually lives the shortest time? (Class answers) ....That has a cross *after* it. Now look at the second example, "train, mule, horse, bicycle, steamboat." Of those five, which goes fastest? (Class answers)........Put a line under it, in just the way that there is a line under "man" in the first example. Which goes slowest? (Class answers)........Put a cross after it, in just the way that there is a cross after "hen" in the first example.

Now look at the list numbered 1. Put a line under the thing that is heaviest, and a cross after the thing that is lightest.

Look at list number 2. Put a line under the thing it is hardest to break, and a cross after the thing it is easiest to break.

Look at list number 3. Put a line under the thing that costs most, and a cross after the thing that costs least.

Look at list 4. Put a line under the game that it takes most people to play, and a cross after the game that it takes fewest people to play.

Look at list 5. Put a line under the holiday that comes nearest New Year's and a cross after the holiday that comes nearest the middle of the year.

Look at list 6. Put a line under the tool that is hardest to sharpen, and a cross after the tool that is easiest to sharpen.

Next look at list 7. Put a line under the most important man and a cross after the least important man.

Next look at list 8. Put a line under the safest way to send money, and a cross after the least safe way.

Now list 9. Put a line under the disease that it takes longest to get well from and a cross after the disease one recovers from quickest. Now the last list. Put a line under the man who must have most skill, and a cross after the least skilled worker.

X. Analogies. (Time 3 minutes.)

Now the last test of all. The first example reads: girl-woman: boy-man. When a girl grows up, she is a woman: when a boy grows up, what is he? (Class answers)......So "man" should be the fourth word for it finishes the meaning of the other three words. Look at the second example. It reads sun—day; moon—......The sun shines during the day, and the moon—when? (Class answers)........So "night" is the right word for it finishes the meaning of the other three words. All write "night" on the line after "moon." Now look at the third example. It reads, good—bad; big—......There is good and bad and big and ....? (Class answers.) So what word should be written after "big?" All of you write "little" (or "small") after "big." Now go through all the other twenty lists in just this way, writing on the line after each list the word you need to finish the meaning of the other three. If you come to a list you can't do, skip it and go on.

III. Results

These group tests have been given to 1022 children in the Bloomington public schools; to about 500 pupils in one, two, and three room country schools; to 200 cases in the State School for Feebleminded Youth at Ft. Wayne; to a special class of 23 children possessing superior intelligence and to two control groups in Louisville, Ky.; to 178 colored children; to the entire school population at Jeffersonville, Indiana; 769 cases; to all school children below the 11th grade in Bedford, Indiana, 1009 cases; to the fifth grade pupils at Logansport, 277 cases; and to the sixth grade pupils at Richmond, Indiana, 308 cases. The effort has been to obtain data from as great a variety of cases and localities as possible to give a wide basis for the study of the various sociological and educational problems mentioned above.[8] The writers have been particularly interested in analysis by test, for race, sex, and environmental variations.

The results of these special studies will be presented and discussed in later papers. The present article will give only norms by age and by grade, obtained from the 1022 Bloomington children, plus such other material from the further studies as is necessary for an interpretation of these results. The Bloomington norms are presented in Table I.

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[8] The writers wish at the outset to express their obligations to the school officials and teachers, who have co-operated in the study, to Dr. George S. Bliss, Superintendent of the State School for Feebleminded Youth, and to Miss Henrietta V. Race, in charge of the psychological work in the schools of Louisville, Ky. Without their co-operation and interest this study could not have been made.

TABLE I

Group Point Scale results from 1022 School Children in Bloomington

Age	No. cases	10%	M.	90%	Grade	No. cases	10%	M.	90%
8	53	37	63	87	3	116	28	52	81
9	92	40	71	108	4	99	42	65	94
10	96	44	93	124	5	96	73	98	114
11	114	62	105	141	6	108	88	110	136
12	117	82	116	148	7	123	103	124	146
13	111	95	127	155	8	122	112	133	156
14	133	101	138	164	I	123	127	146	167
15	104	111	149	167	II	97	135	155	165
16	89	129	152	169	III	82	141	156	173
17	80	129	152	169	IV	56	153	162	171
	986*					1022			

* Below eight and above seventeen, there were too few cases at each age to give a reliable norm. These cases have, therefore, been omitted from the statement of results by age, though of course included in the figures by grade.

The all important question now arises as to the reliability of the scale, and the significance, sociological and educational, of the ratings; the prime advantage (for the psychologists) in a combination of a psychological and a sociological survey was expected to appear in the possibility of obtaining interpretations of the mental measurements in terms of a large mass of educational and sociological data. From the data so far gathered the following facts have been selected as most pertinent to these questions.

IV. The Validation of the Scale

An indication of the significance of these tentative norms has been obtained from the following five sources.

1. The reliability of the group tests to indicate the extreme cases has been checked up by Binet examinations. Throughout the survey the Stanford-Binet scale has been used as the final basis for making a psychological diagnosis of feeble-mindedness. The use of the Binet scale has been most systematic in two Bloomington graded schools. In these schools 21 cases were found with an I.Q. of 76 or below, who had also been examined by the group scale. They averaged at the 4 percentile of their age by the group tests; the highest scores made by these cases were at the 8 percentile. In those

two schools a total of 317 children had been given the group tests. Of these 68, or 22 per cent, were given Binet examinations in an effort to discover all low grade cases. Teachers' estimates, age-grade status and group scale ratings were all used in selecting the cases to be examined by the Binet scale, and the writers feel that errors made by the group scale in the rating of the low grade cases should have been discovered if they had occurred. On the basis of these results, the writers have been using the 10 percentiles as a limit above which a search for mental defectives need not go. The comparative reliability of this method may be indicated by the fact that two cases with I.Q.s below 70 were found which had not been included by their teachers in lists of the poorest fifth of the class.

According to Terman the group of cases having I.Q.'s 76 or below constitutes 3 per cent of the total distribution of abilities. A similar effort was made to discover supernormal children, the group which, according to Terman, makes up the upper three per cent. The Binet work with these brilliant children was not so systematic as was the search for mental defectives. Group test scores are available, however, from 30 children who gave an I. Q. rating of 125 or above. The average standing of this group as determined by the Group tests is roughly at the 98 percentile. For the eight-year-olds there were two, who fell below the upper ten percentile, one at the 51 percentile, the other at the 88 percentile. Above this age all are included at the 85 percentile or above. These children were all ten or younger; with older children the accuracy would probably be greater.

2. The purpose of the county survey was to determine—not the number of children with an I.Q. below 70—but the number of mental defectives of institutional grade. The most direct way to obtain data giving an indication as to the reliability of the group scale for this purpose would, therefore, seem to be to survey with the Group Scale an institution for the feeble-minded. As part of all the standardization of the scale the writers, therefore, gave the tests to all the cases in the State Institution for Feeble-minded Youth sufficiently literate to take the examination. Similarly, not merely children with an I.Q. above 125, but superior children who had proven themselves capable of profiting by intensive special class treatment in a "gifted" class were needed to give an indication as to the reliability of the scale to select brilliant children. A class of brilliant children at Louisville were there-

fore examined.[9] The "School for Feeble-minded Youth" has 416 cases 18 years of age or below. Of these, only three were able to make a rating above the lowest ten percentile of the school children of the same ages. One of these three has a Stanford Binet I.Q. rating of 78, for the other two no Binet ratings are available. Only five show a group scale rating above the lower five percentile. The institutional cases, then, are clearly marked off from the group of school children. At the other extreme, the Louisville group of gifted children made scores averaging at the 98 percentile of the Bloomington norms. This is, therefore, also a distinct group which may readily be selected or differentiated by the group tests.

3. The age-grade status of a child is, at least for all except the first grade or two, the most definite single statement which the school can give regarding his mental ability. The age-grade status has been worked out for all the children examined by the group scale in Bloomington, six to eight being considered normal for the 1B grade, and so on up. The results on this point may again be summarized briefly by saying that the 143 retards in the ages from 10 through 16 average 70 points lower on their group test score than the 124 accelerates of the same ages, or to put it another way, the differences average 55 per cent of the medians at each age. In the entire number of cases (986) from 8 through 16, there are only 10 accelerates whose group test score was below the median for their age and only five retards whose score was above the median for their age.

4. It has not been possible to obtain correlations of teachers' estimates with the group scale ratings for all the children tested. Such correlations have, however, been worked out for the children in one grammar school in Bloomington and for all the sixth grade children in another system who were examined by the group scale. These rankings by the teachers were in both instances called for in the last month of school, after the teachers had had an entire school year in which to become acquainted with the children's abilities. The correlation of group test rank with teachers' rank, averages .65 for the 131 children of the Bloomington graded schools, and for the 309 sixth grade children is .63 (Spearman "foot rule").

5. It might be argued from the last two paragraphs that the tests were rather tests of achievement or of school ability than of general intelligence. Data of great interest in this

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[9] Henrietta V. Race, A Study of a Class of Children of Superior Intelligence, *Journal of Educational Psychology*, vol. 9, 1918, pp. 91-97.

connection have been obtained from two other school systems recently surveyed by the scale. In one 1009 children were examined, in the other 769, so that the results are adequate for comparative purposes. The three cities are largely similar in make-up of population; in all the stock is almost entirely native born, and with this large number of cases the averages would be expected to be about the same by age if the scale was a measure of general intelligence. But the school systems differ considerably. The results obtained by the group tests by age show an average difference for the medians of less than 2 points in these cities, whereas the differences by grade average 13 points. If the tests were a measure of the results of schooling rather than general intelligence the norms would be more similar for the grades than the age. These last results, the writers feel, are a striking vindication of the tests as tests of general intelligence, and as largely free from the influence of special training.

SUMMARY

The paper may be summarized briefly as follows:

1. The group point scale is an examination, composed of ten tests each of twenty items, each test being applicable from the third grade through high school, or from eight to about sixteen years.

2. The examination is especially adapted, in the nature of the individual tests, the variety of the tests, and particularly in the close relationship and co-operation between examiner and class, for work with grade school children. It gives a much more adequate mental rating for such children than a more artificial and set examination could give.

3. The examination is carefully planned, in both detail and organization, for convenience in practical work and in research.

4. The ratings obtained show, when correlated with other independent sociological and educational evidence, a high degree of reliability as measures of general intelligence.

THE VALUE OF RELEVANCY IN ADVERTISEMENT ILLUSTRATIONS[1]

By HERBERT R. LASLETT, University of Kansas

If relevancy be defined as the portrayal (in the illustration of the advertisement) of the ultimate usefulness of the article advertised, how closely should relevancy be adhered to in the average non-trade, non-professional magazine? This paper contains the data obtained in an effort to answer scientifically this question.

Objectively this question is of importance because it bears upon the construction of advertisements to the end that they may be brought to a high standard of efficiency (which means that they are economical in terms of money expended and money received resultant from an original outlay), and it is of importance therefore to the advertiser, the publisher, and the reader. Subjectively this matter bears upon the average amount of subject-matter retained out of the advertising aggregate seen by the reader of these so-called popular magazines.

Psychologically it bears relation to the number of steps of progressive thinking that the average reader will make, or to the duration of the effort that he will make, to connect an article as shown in a magazine advertisement with himself; or, in other words, relevancy in illustrations is closely related to the pulling power of an advertisement.

In making these tests the main dependence for material was placed upon two copies of the *Saturday Evening Post,*—one of the issue of December 2, 1916 and the other of the issue of March 24, 1917. The bindings of these magazines were cut, and full-page advertisements selected from other issues were inserted in their proper page places, that is, the selected advertisement was inserted after page 64 of the test magazine if it was numbered 65 in the magazine from which it was taken. In this way no cue to the insertion of any pages was given to the subjects. It is needless to say that the inserted advertisements were chosen because they were clearly relevant or irrelevant, as the case may be. The pages of the new magazines were then fastened together with heavy spring-clips.

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[1] From the Psychological Laboratory, University of Kansas.

The advertisements with relevant illustrations that were chosen as test advertisements showed the article that they represented in actual use by some one evidently of the same habits as the majority of the people who would see the advertisement; for example, the young man in the Pullman car drying his hands on a Scottissue towel, or the Black Cat stockings that looked to be sound and durable in spite of the hard usage given them by the healthy youngsters on their roller skates. The other kind may be illustrated by such examples as the Gold Medal Flour advertisement showing a clown balancing upon his nose a rectangular object that proved, after some study, to be a baking pan, and beneath it the words 'A Well Balanced Baking,' or the Encyclopedia Brittanica advertisement showing the setting sun surmounted by the words "after 7:30 June 3rd." The text that followed this illustration showed eventually that after June 3rd the encyclopædia could be bought only for a sum that was a large increase over the price for which it was then selling. The advertisements selected for one magazine were:

1 Society Brand Clothes, March 24, 1917.
2 Lyon's Tooth Powder, same issue.
3 Westinghouse Fans, July 8, 1916.
4 Scottissue Towels, May 27, 1916.
5 Goodyearite Packing, May 27, 1916.
6 Certainteed Roofing, September 2, 1916.
7 Wagner Products, June 17, 1916.
8 Holeproof Hosiery, September 4, 1915.
9 Textan Shoe Soles (Goodrich Co.), March 24, 1917.
10 Stewart Auto Products, January 29, 1916.
11 Neolin Shoe Soles (Goodyear), January 29, 1916.
12 Kellogg's Corn Flakes, February 5, 1916.
13 Black Cat Hosiery, August 26, 1916.
14 Stetson Hats, March 24, 1917.
15 Main Belting Co., June 24, 1916.
16 Stewart Warning Signals, June 17, 1916.
17 Florence Oil Stoves, April 22, 1916.
18 Goodyear Rubber Products, January 29, 1916.
19 Encyclopædia Brit. (Sears, Roebuck & Co.), June 3, 1916.
20 Ralston Wheat Foods, March 24, 1917.
21 Hammermill Bond Paper Co., March 24, 1917.
22 Maytag Washer Co., March 24, 1917.
23 Gold Medal Flour, March 24, 1917.
24 Gordon Seat Covers.
25 Pullman Company.
26 Beaverboard Wall Covering.

Students, mostly of the sophomore class, of the University of Kansas were used as subjects; they were members of the elementary psychology laboratory classes, but were unacquainted with the purpose of the experiment. The Pleasant Hour Club—a group of farm women—was also used for the sake of studying the correlation between their interests and those of the students in order that the value of students as subjects for experiments in advertising might be estimated.

In addition, series of advertisements of Packer's Tar Soap, Fairy Soap, and Nujol were used upon various subjects, both in and out of University circles. They were asked to arrange these advertisements in the order of their preferability and attractiveness and then to state, as far as they were able to do so, their reasons for arranging them in a given order. The only requirement made in the selection of these people was that they be unversed in the problems of advertising. Their observations of the meanings of some of the irrelevant advertisements are given later. Their arrangements of the advertisements in the order of preferability coincided with the arrangement for relevancy to the extent that 60 per cent of the advertisements placed in the upper half according to their relevancy were also in the upper half according to their preferability. The exceptions were the 'human interest' pictures of the Fairy Soap, to which in an indirect way a certain amount of relevancy may be attached.

The following method was used in the laboratory: the magazine was given to the various members of the classes as they were found in the laboratory working in pairs. The instructions given to them were that they should have from five to seven minutes to look at the magazine as a whole, that they were not to read the stories, that they were not to talk over the magazine in the laboratory nor later outside of the laboratory, and that for the time being they were to give their whole attention to the magazine. It was thought that in this way the ordinary conditions under which magazines are read by the average reader could be most nearly duplicated. On the second day after the first review of the magazine, it was again given to them to look over as before. On the fifth day after the second review (the next current laboratory period) these students were assembled in the classroom and each given a paper upon which to record, in the first place, the names of all of the advertisements which they could remember. The directions given at this time were that there should be no talking nor assistance to each other, that the article advertised, as gum, together with the trade name, e.g., Spearmint, were to be written whenever possible. (Spearmint Gum was not in the advertisements included in the magazines.) In the second place those cases were to be mentioned in which either the trade name, as Standard Oil Company, or the article advertised together with enough description of the advertisement could be given to make the identification of the advertisement possible. The more definite recollections given in the first place were treated separately from the less definite ones given in the second place. The recollections of the relevant and irrelevant advertisements were recorded in separate tables.

Practically the same plan was used with the members of the Pleasant Hour Club, except that they saw the magazine but once and wrote down immediately the advertisements remembered.

The results with Magazine 'A' from the seven sections of

TABLE I

Relevant Advertisements (Magazine A)	1st Class	2nd Class[2]
Crisco	10	0
Elgin Watch	26	8
Simmon's Watch Chains	15	11 (a)
Velvet Tobacco	44	4
Welch's Grape Juice	17	5
Western Electric Co	9	4 (b)
Holeproof Hosiery	18	11
Average	20.0	6.1

Irrelevant Advertisements	1st Class	2nd Class
Brascolite	1	1 (c)
Cadillac	10	0
Encyclopedia Brit	7	2
Hoosier Kitchen Cabinet	5	1
Main Belt Company	0	2
Manuola Player Company	1	0
Maytag Washer Company	0	0
Perfection Auto Heater	0	0
Stewart Speedometer Co	6	2
Southern California (Gen. Publicity)	10	11 (d)
U. S. Rubber Company	11	0
Vim Motor Company	21	0
Saturday Evening Post Adv	4	0 (e)
Average	5.8	1.7

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[2] Examples of descriptions of advertisements which are counted in Class 2 because of sufficient definiteness are the following: (a) "A picture of Norma Talmadge and some other actor wearing wrist watch and watch chain;" (b) "Electric sewing machine with woman sewing;" (c) "Do patent laws protect"—a lighting system; (d) "See California," "railroad rates to California," "California—motorists paradise"; (e) "Arthur Brisbane, the highest paid editor in the United States."

students were combined, as there seemed to be no essential differences between them, and these are represented in Table I. The column headed "1st Class" gives the number of times that each advertisement was mentioned in the first place, and the column headed "2nd Class" shows how frequently each advertisement was mentioned in the second place. The corresponding results with Magazine B are shown in Table II.

TABLE II

Relevant Advertisements (Magazine B)	1st Class	2nd Class
Society Brand Clothes	7	3
Lyon's Tooth Powder	2	0
Westinghouse Fans	15	3
Scottissue Towels	1	1
Holeproof Hosiery	9	2 (3)
Kellogg's Corn Flakes	19	2
Black Cat Hosiery	5	2
Florence Oil Stoves	3	1
Ralston's Breakfast Food	8	2
Stetson Hats	3	0
Hammermill Bond Paper	4	0
Textan Shoe Soles	5	2
Average	6.6	1.5

Irrelevant Advertisements	1st Class	2nd Class
Gold Medal Flour	0	2
Certainteed Roofing	2	2
Goodyearite Packing Rubber	3	0
Wagner Elec. Manufg. Co	0	1
Stewart Auto Products Co	1	1
Neolin Shoe Soles Co	8	1
Main Belt Company	0	0
Stewart Warning Signals	2	1
Goodyear Rubber Products	4	4
Encyclopedia Brit	2	0 (3)
Maytag Washer Company	6	2 (3)
Average	2.5	1.2

TABLE III

Relevant Advertisements (Magazine A)	
1. Crisco	4
2. Elgin Watch	3
3. Simmon's Chains	0
4. Velvet Tobacco	4
5. Welch's Grape Juice	2
6. Western Elec, Sew. Mach. Co	0
7. Holeproof Hosiery	1
Average	2.0

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[3] In these cases the advertisements in Magazine B are not the same as those shown in Magazine A.

TABLE III—*Continued*

Relevant Advertisements (Magazine B)

1.	Society Brand Clothes	2
2.	Lyon's Tooth Powder	6
3.	Westinghouse Fans	8
4.	Scottissue Towels	3
5.	Holeproof Hosiery	3
6.	Kellogg's Corn Flakes	6
7.	Black Cat Hosiery	4
8.	Florence Oil Stoves	4
9.	Ralston Breakfast Food	4
10.	Stetson Hats	2
11.	Hammermill Bond Paper	0
12.	Textan Shoe Soles	0
	Average	3.5

Irrelevant Advertisements (Magazine A)

1.	Brascolite	0
2.	Cadillac	0
3.	Encyclopedia Brit	0
4.	Hoosier Kitchen Cabinet	2
5.	Main Belt Co	0
6.	Manuola Player-piano	0
7.	Maytag Washer Co	0
8.	Perfection Auto Heater	0
10.	Southern California (ad.)	0
11.	U. S. Rubber Co	0
12.	Vim Motor Company	2
13.	Saturday Evening Post	1
	Average	0.5

Irrelevant Advertisements (Magazine B)

1.	Certainteed Roofing	0
2.	Goodyearite Packing Co	0
3.	Stewart Auto Products	0
4.	Neolin Shoe Soles	2
5.	Main Belt Co	0
6.	Stewart Warning Signals	0
7.	Goodyear Rubber Co	0
8.	Encyclopedia Brit	2
9.	Maytag Washer Co	0
10.	Gold Medal Flour	0
	Average	0.4

In the papers of the Pleasant Hour Club there were only recalls of the first class. The results are given in Table III.

By converting the actual frequencies of the preceding tables into percentages we obtain the results as presented in Table IV.

TABLE IV

Relevant	1st Class	2nd Class	Total
Magazine A with students	17	5.6	
Magazine B with students	9.8	2.9	
Magazine A with clubwomen	33	—	
Magazine B with clubwomen	58.2	—	
Total	118.	8.5	126.5

Irrelevant	1st Class	2nd Class	Total
Magazine A with students	5.3	1	
Magazine B with students	3.6	1.9	
Magazine A with clubwomen	0.8	—	
Magazine B with clubwomen	0.6	—	
Total	10.3	2.9	13.2

These results seem to allow of no doubt as to the comparative value of relevancy in the magazine cuts as against

TABLE V

APPREHENSION TIMES

	Relevant Advertisements	Average for 15 subjects	
1.	Society Brand Clothes	9.3	seconds
2.	Lyon's Tooth Powder	10.6	"
3.	Westinghouse Fans	10.5	"
4.	Scottissue Towels	8.1	"
5.	Holeproof Hosiery	5.7	"
6.	Kellogg's Corn Flakes	6.8	"
7.	Black Cat Hosiery	6.6	"
8.	Stetson Hats	7.7	"
9.	Florence Oil Stoves	8.8	"
10.	Ralston Wheat Food	4.9	"
11.	Hammermill Bond Paper	15.0	"
12.	Textan Shoe Soles	11.6	"
13.	Gordon Seat Covers	6.3	"
14.	Pullman Company	8.5	"
15.	Beaverboard	10.6	"
	Average	8.73	"
	Irrelevant Advertisements		
1.	Certainteed Roofing	26.2	"
2.	Goodyear Packing	22.3	"
3.	Wagner Electric Co	34.2	"
4.	Stewart Products (auto)	22.2	"
5.	Neolin Shoe Soles	9.3	"
6.	Main Belt Company	18.1	"
7.	Stewart Warning Signals	15.5	"
8.	Goodyear Rubber Products	27.0	"
9.	Encyclopedia Brit	19.9	"
10.	Maytag Washer	16.5	"
11.	Gold Medal Flour	22.1	"
	Average	21.25	"

irrelevancy in the illustrations, since nearly ten times as many advertisements with relevant illustrations are recalled as those containing irrelevant illustrations.

As a check upon the validity of the selection of the advertisements as relevant or irrelevant, the advertisements of Magazine B containing both the relevant and irrelevant illustrations were used with a group of fifteen students who were unfamiliar with the tests, and the apprehension-times of these subjects were taken for each advertisement. Apprehension-time was considered the shortest time-interval necessary to elapse in order for the subject to name the article advertised or the company advertising and one point of advantage or superiority of the article mentioned in the text of the advertisement or easily inferrable from it. Table V shows the results of this test.

It will be seen that in only one case was the apprehension-time of an irrelevant advertisement less than the longest apprehension-time of a relevant advertisement, and thus the selection of the advertisements as easy or difficult of understanding was verified in all cases except this one of the Neolin Shoe Soles. A partial explanation of the short time of this advertisement may be the fact that it came after the advertisement of Textan shoe soles more often than not and thus attention directed to composition soles was carried over from the latter to the former advertisement.

Taking up some of the minor phases of the experiment we may consider the position of the selected advertisements within the magazines, the relative frequency of the advertisements, the intensity of the advertisements used, and the occurrence of advertisements by the same firm in both magazines.

In the matter of favorable and unfavorable positions, one of the advertisements was placed immediately preceding the reading matter . . . presumably the best position in the magazine . . . and another was on the back cover. Both were within the median percentiles of number of recalls. The other advertisements were scattered through the advertising sections and varied in number of recall apparently without regard to their positions in the sections.

As regards frequency of appearance of the advertisements, the more common advertisements were not used in our tests. So far as is known to the writer none of the selected advertisements appeared in the magazines commonly read by students during the week of the experiment or the week preceding it, except that a few of the test advertisements were selected from the original issue of the magazine used. The advertisements selected were as nearly equal in frequency as possible. It is believed now, however, that one reason for the high number of recalls received by the Velvet tobacco advertisement is its relatively greater frequency of appearance, and the credit it gains from the advertising of similar products, such as Prince Albert and Tuxedo.

The intensities of the contrasts of the cuts were as nearly the same as it seemed possible to choose them, with the exception of the irrelevant advertisement of the Vim Motor Company in Magazine A. This advertisement was recalled 22 times out of a total of 76, or almost one-third of all the cases. It is needless to say that the intensity of this advertisement seemed to be greater than that of the other advertisements. As none of these were favored to a similar degree, it would seem that their intensities were nearly equal.

In the matter of placing two advertisements of the same firm in both magazines, there was no notable increase in the number of recalls of the second advertisement over the first. This is significant because it leads to the conclusion that no matter how frequently an advertisement is inserted, if it has little attention value, no benefit will be gained from the second or third insertion if it is not noticed in the first.

In regard to the subjects used, students were used because they were available in the greatest numbers and were as good subjects as could be obtained. The women of the Pleasant Hour Club were used because it has been found that the women do more than half of the family buying, and the articles advertised in the *Saturday Evening Post* and other popular magazines are of the sort where the influence of women would be keenly felt.

In listing the apprehension-times it was evident from the first that students turned much more readily to the advertisements whose general subject matter was in some degree familiar to them, thus evidencing the inertia of attention that advertisements must overcome.

Among the advertisements mentioned by the students were some not found in the magazines. Phoenix Hosiery was mentioned six times because it was mistaken for the Holeproof advertisement. Old Dutch Cleanser was mentioned presumably because its advertisements are nearly always in the *Saturday Evening Post.* Ivory Soap was mentioned three times for probably the same reason. Big Ben clocks, Prince Albert tobacco, Royal Tailoring Company, and Overland cars were likewise mentioned by mistake, as they were not found in the test magazines: this is perhaps due to the constant advertising of these concerns.

To summarize our results: it was found that advertisements containing relevant illustrations were remembered nearly ten times as often as advertisements with irrelevant cuts. In the case of the former kind, the name of the firm or of the *article advertised together with one point of* the latter's superiority was apprehended from two to three *times as quickly* as in the case of the irrelevant illustrations. The employment of university students as subjects in psychological tests on advertising is justified, since no significant difference was found between them and a class of women who represent the purchasing public. Other well-known facts of the psychology of advertising, such as the influence of the size of advertisements, of the frequency of their appearance, of the intensity contrast of their illustrations, of the surrounding reading-matter, and the like, were confirmed by our results.

FURTHER COMMUNICATIONS REGARDING "A PLAN FOR THE TECHNICAL TRAINING OF CONSULTING PSYCHOLOGISTS"

Dr. Leta S. Hollingworth, Teachers College, Columbia University, sends the following:

TENTATIVE SUGGESTIONS FOR THE CERTIFICATION OF PRACTICING PSYCHOLOGISTS

It is with pleasure that I accept the invitation of *The Journal of Applied Psychology* to participate in the symposium on qualifications for psychological experts. Since my own practical experience has been very largely in the so-called clinical field, I do not doubt that what I have to say will be conditioned to a great extent by that experience.

In the first place, there is distinction among the various fields in which psychologists serve, in spite of the fact that there is much overlapping among these fields. We have educational psychology, industrial psychology, clinical (medical) psychology, etc. Not only are these various fields to be distinguished, but upon reflection it becomes clear that they are at the present moment in different stages of development, both in regard to the preparation obtainable in the universities, and in regard to the actual demand for services to be rendered.

It is my impression that so-called clinical psychology is more advanced in many respects than are the others. Educational psychology, though well established, has devoted itself to teacher-training, rather than to the development of the expert educational psychologist; so that the latter (insofar as he can be differentiated from the clinical psychologist) is among the most recent innovations. Industrial psychology can hardly be said to be taught as yet, even in first rate university departments (Carnegie Institute for Technology being a notable exception). On the other hand, preparation for clinical psychology is now being offered in several of the large universities; the demand for psychologists in this field is steady and increasing; a national association of those already in the field has been formed; and some of the states have even set legal standards for the practice of clinical psychology.

This inequality of development in the various branches of applied psychology complicates the matter of certification of individuals. Certification in the clinical field seems feasible and necessary at this time, whereas certification in the industrial field seems impracticable.

In the present state of affairs, it seems to me that the most workable plan is to certify institutions. Let there be a standing committee of a responsible body, such as The American Psychological Association, to prepare a list of departments of psychology, where prescribed training has been made available. This list should be published annually, and printed in the report of the A. P. A., and in the technical journals, and posted in departments of psychology. Then, for the immediate present, *let the certified institutions certify individuals*, by conferring upon qualified persons the prescribed diploma.

In this there would, of course, be nothing legally mandatory. Ultimately the legal certification of individuals must be brought about, but in my judgment this will not be practicable until the courses of study have been standardized, and have actually been offered for three or four years at the universities.

As to the various degrees of expertness, and the recognition of each by means of a suitable diploma, Dr. Geissler in his initial article on the subject, distinguished three possible levels of skill. It seems to me that but one level of fitness should be certified, namely the fitness of an individual who will be an expert psychologist, with all the knowledge necessary (so far as knowledge is available) for the direction and control of human behavior. This person should earn and receive a doctor's degree in psychology, and should be given a professional diploma as Psychologist.

Many will hold that the grade of attainment represented by the master's degree (a college course and one year of specialization beyond), should be distinguished and certified. At times it seems to me that this should be done, and that some such title as Assistant Psychologist should be conferred; yet the more closely I consider the question the more convincing seem to me the arguments against certifying an inferior grade of training. Will not such certification tend to create a supply of certified inferior and hence inexpensive service, the inferiority of which will be condoned in many quarters for the sake of the inexpensiveness? Will not the distinction between Psychologist and Assistant Psychologist be too vague to function, especially since one costs much more than the other? And will not the whole purpose of the attempt at standardization be thus frustrated? For, as I conceive it, the purpose of standardization is twofold, (a) to assure the best possible quality of service to the public, and (b) to protect those who are able and willing to undertake thorough preparation against the competition of those who are unable or unwilling to undergo the same training. The accomplishment of the first purpose is inseparably bound up with the accomplishment of the second.

It may be argued that the doctor's degree in psychology is at present awarded largely on the basis of research, in our most completely equipped universities, and hence requires a higher type of intellectual capacity than is necessary for the average practitioner. To me it seems doubtful whether the average successful candidate for the doctor's degree in psychology has more intellectual ability than should be required of one who aspires to be trusted with the direction and control of human behavior. It is at least doubtful that the average ability of those who have won the doctorate in psychology during the decade just passed is higher than that of the graduates of good professional schools, such as schools of medicine and schools of engineering. As fast as really good prospects are established in applied psychology, really good people will come to qualify,—people who are fully capable of earning a doctor's degree. But prospects in applied psychology will not be good, so long as persons of mediocre qualifications occupy the field.

It has been suggested that the traditional divisions of academic training into that for the M. A. and that for the Ph. D. are not very fortunate for the present purposes. The Ph. D. is not in a strict sense a professional degree. There exists at present no degree to indicate the completion of a prescribed professional course in psychology, which does not involve intensive research, but which does involve practice in applications. It has occurred to me that perhaps the situation calls for a new departure, the "invention" of a new degree,—Doctor of Psychology,—which would involve six years of training, including college, with an additional apprenticeship year (instead of research). I think this suggestion is worth considering, as the old Ph. D. is scarcely appropriate to many of the modern uses it is made to serve. Sooner or later it ought to fall away from the sciences through sheer weight of its irrelevancy.

As I have often stated, I am convinced by personal experience and by the experience of colleagues in the field, that it will hardly be possible for applied psychologists to succeed (in clinical practice at any rate), without the doctor's degree. The reasons why this is so probably go back, in the last analysis, to the fact that the doctor's degree has come to signify adequate skill in him who presumes to direct human welfare. Thus competing professions can and do play in many subtle ways upon the lack of a professional title, to the detriment of the psychologist's legitimate work and service. Furthermore, the general public is disinclined to accept the advice of one who lacks the title of doctor in his field. Thus the usefulness of the psychologist is materially impaired, in cases where he is not qualified with the doctor's degree. These are phases of social psychology which it is necessary to admit, in considering the matter of certification. To ignore them would be to betray ineptitude as an applied psychologist at the very outset. Either we can fall in with the social habit, or dedicate ourselves to a long and tedious process of reforming it.

This emphasis upon the importance of formal titles, certificates, degrees, etc., does not, I find, impress the academic psychologists, who have not personally experienced the limitations upon usefulness resulting from the lack of a "suitable" title out in the practical field. Thus they are inclined to urge that certification is a relatively insignificant matter, and scarcely worthy of dignified discussion. It seems to them that the only really important consideration is that the instruction shall be of first rate quality. To them it is important that the professional teacher of psychology should have the doctor's degree, but unimportant that the practical psychologist should have it. They feel, somehow, that it probably requires less training and ability actually to direct and control human behavior, than to teach how to direct and control it.

Here we see the difference in viewpoint between the pure scientist and the practitioner. This divergence is inevitable; and it is only to be expected that the majority of psychologists, whose interests are mainly in teaching and research, will not be much moved by the subject which we are here considering, *i.e.*, certificates for practitioners. The adequate solution of the problem is, nevertheless, essential to the progress of practical psychology.

Summary of Suggestions

1. Legal certification of individuals will ultimately be necessary, but for the immediate present is scarcely feasible, owing to the unstandardized condition of curricula, and the inequality of development in the various branches of applied psychology. Standardization of curricula must *precede* legal certification of individuals.

2. For the present, institutions should be certified. Lists of certified institutions should be published. These institutions should be charged, for the time being, with the certification of individuals, by conferring upon qualified persons the prescribed diploma.

3. Only one grade of professional qualifications should be recognized by formal certification: persons who earn the doctor's degree, specializing in psychology as prescribed, should receive a professional diploma carrying the title, Psychologist.

4. The suggestion is worth considering as to whether the situation does not call for an innovation,—the creation of a new professional degree, Doctor of Psychology.

Professor S. C. Kohs, of Reed College, writes as follows:

A WORD REGARDING PLANS FOR THE TRAINING OF PSYCHOLOGISTS

If psychological practice is to become a respectably established institution, then the question of preparation and licensing of psychological practitioners becomes a matter of extreme importance. If the issue is dodged now, psychology will have to face it in some aggravated form later on.

The American Medical Association has for years exercised careful scrutiny over medical education in this country. This supervision has meant immeasurable benefit to the medical profession and to society. Practically every state specifies clearly the grade of the college, as assigned by the American Medical Association, from which prospective physicians may be accepted. Recently a national examining board was established and two national examinations have thus far been held. But these conditions have been the result of years of active and bitterly opposed propaganda. It seems reasonable to expect that the practice of psychology will pass through a somewhat similar evolution. But the American Psychological Association, profiting by the experience of the medical organization, can attain the same influence in its field with a considerably smaller expenditure of effort if active measures are taken before quackery obtains a substantial foothold. There should be a standing committee of the American Psychological Association which should set standards of training for the various types and grades of applied psychology: clinical, educational and vocational, and which should act as a national examining board, granting degrees or licenses to properly qualified individuals. I think it would prove unwise to delegate this power to individual college or university departments, as has been suggested.

A symposium on this subject at the present time is most opportune. When the war is over psychology, together with all our other sciences, will be called upon to contribute its maximum toward social reconstruction. It must stand ready to perform this task respectably and with credit.

BOOK REVIEWS

Osias L. Schwarz. *General Types of Superior Men.* With a preface by Jack London, and an introductory letter by Max Nordau. Richard G. Badger, Boston, 1916, p. 435.

The book contains ten chapters which may well be grouped into six divisions as follows: (1) Ch. I, Definition, General Characteristics of Genius and Talent; Ch. II, Origin and Conditions; (2) Ch. III, Types of Superior Men, Intellectual Hierarchy; (3) Ch. IV, Creative Life, Ch. V, Affective Life, Ch. VI, Striving Life; (4) Ch. VII, Influence upon the Masses; (5) Ch. VIII, Appreciation; (6) Ch. IX, Normality and Abnormality.

In the first chapter the author gives a rather extensive characterization of the genius, the talented and the philistine individual. In this he points out the characteristic memory imitation, verbosity, impressionability, mental harmony, affection and volition which the genius possesses. In the treatment of the heredity and variability of the genius it becomes difficult for one, in the light of present biological principles, to accept some of the unique theories of the author. On page 85 he states: "To produce a genius, the qualitatively similar characters of the parents must be added algebraically; a geometrical addition gives birth to common mortals and talented men."

Chapter II shows the value to society of the philistine group, but the importance of the genius to society is kept in the foreground through the whole book. In connection with this some of the forces, as pain, poverty, etc., which aid or suppress the genius, are treated very well. The high intellectual status of the superior group is treated in more detail in chapter III. The fourth chapter, while termed "The Creative Life," is really a further elaboration of chapter I. Chapters V, VI, and VII deal with the affective and striving life and will be of interest to readers of Social Psychology. Chapter VII treats of the vital relation of the talented person to his social environment and his contribution to the group. The mutual relation between the individual and the group receives emphasis in chapter VIII. Chapter IX is somewhat apart from the rest of the book, although the general idea of the author is still apparent. It would not be impossible to omit this chapter, yet it will be of some interest to the general reader.

The title of the book would be truer to the discussion with the word "Superior" omitted, as all classes are treated, but emphasis is placed on the highest type of person, the genius. With this individual the author compares the talented man and the philistines, or average persons. This discussion is interesting in connection with McDougall's élite group, and *The Great Society* of Wallas. "Philistines differ from geniuses in both aims and abilities. The talented man differs from the genius belonging to the same class more in ability than in aims," p. 16. The author has followed the literary style of Lombroso or Havelock Ellis. Quite often the linguistic style of the author attracts the attention away from the point which he wishes to make. All references to works which he has undoubtedly made use of are omitted. While the reader may not notice this lack of references, one cannot escape the feeling that some of the author's statements without the signs of a quotation are really direct quotations; p. 415-6, for example: "Women as a rule are born philistines: . . . to fall into their hands."

In many places the reader feels that the author did not make use of *the most recent and accepted views in biology, sociology, and psychology.* ". . . genius . . . can be regarded as a result of accumulation or summation of inherited unconscious tendencies, of inherited cosmical-suggestive impulses," p. 84. "Only those acquired characters are transmitted hereditarily which affect strongly the parent's organism, . . .," p. 84. "In animals not only habits or acquired characters but also actions performed but once may become instinctive or hereditary modes of behavior, . . .," p. 113. "We understand why for women, knowledge, or truth, is still a means to success, and has not yet become an end-in-itself," p. 412.

The author has crowded his statements full of ideas and his sentences almost resemble aphorisms. The book will be of interest to students of social psychology and sociology, and to the layman who wishes a popular treatment of the characteristics of the élite group in comparison with the philistine group.

J. E. Evans.

Lewis M. Terman, Grace Lyman, George Ordahl, Louise Ellison Ordahl, Neva Galbraeth and Wilford Talbert. *The Stanford Revision and Extension of the Binet-Simon Scale for Measuring Intelligence.* Educational Psychology Monographs No. 18. (Edited by Guy Montrose Whipple.) Warwick and York, Inc., Baltimore, 1917, p. 179.

This monograph summarizes the data on which is based Terman's revision and extension of the Binet Scale as published in his *Measurement of Intelligence.* After a "Brief Account of the Stanford Revision and its History" in chapter I the authors discuss in the subsequent seven chapters the following topics: "The Distribution of Intelligence," "The Rate of Growth and the Validity of the I. Q.," "Sex Differences," "The Relation of Intelligence to Social Status," "The Relation of Intelligence to School Success," "The Validity of the Individual Tests," and "Some Considerations Relating to the Formation of an Intelligence Scale." Among the reasons why the authors claim "that the Stanford 1914-1915 data have more than ordinary significance" are: the great number of children, namely 981, varying between 80 and 120 at each age from 6 to 14 years, with somewhat fewer at 5 and 15, the great uniformity and care in the conduct and scoring of the tests, the selecting of children within two months of a birthday, and the elimination of racial differences. Consequently the distribution of intelligence for the ages separately as well as for combined ages as based upon the Intelligence Quotient follows very closely the theoretical (Gaussian) normal frequency curves. The curves show that the distribution of mental ages becomes progressively flattened the older the children. The authors believe that the results of tests repeated on the same children at various intervals as far as they have been made, "support in a general way the hypothesis that the intelligence quotient of a given child tends to remain constant" and that "growth of intelligence comes to a standstill somewhere in the later years of adolescence and that the cessation is gradual rather than sudden." The data on hand also throw doubt upon the common notion that mental development progresses alternately at slower and faster rates. A slight sex-difference in favor of the girls seems to occur between 5 and 14 years of age, and in certain tests sex-differences were unexpectedly well marked. "The median intelligence quotient for children of the superior social class is about 7 points above, and that of the inferior social class about 7 points below the median intelligence quotient of the average social group." The superiority seems to the authors to be "almost certainly due primarily to superior original endowment," and they base this conclusion upon five supplementary lines of evidence which are fairly convincing. The results also show a very close agreement between the intelligence quotient and the quality of school work as judged by the teachers. The cases of disagreement are mostly due to the teacher's oversight of age differences. As a consequence "superior children are seldom allowed to reap the advantages in school progress, to which their superiority fairly entitles them." The authors point out that a given amount of retardation or acceleration is not equally significant at the different ages, which fact has been most consistently overlooked by many students of the problems of age-grade progress. The last two chapters are of especial importance from the standpoint of the theory of mental testing and intelligence scales. The three criteria for the validity of a test in an intelligence scale are said to be increase in per cent of unselected children that pass it, internal coherency, and reasonably high correlation with intelligence as otherwise estimated. Considering the second of these as the most important criterion, the authors have subjected it to an elaborate statistical treatment and on the basis of it have divided all the tests examined into good, poor and indifferent. Another statistical treatment of results from adults shows that there is no significant influence of school training on the ability to pass most of the tests. The influence of the age-factor is difficult to determine, but the results on the tests involving memory were found to contradict those of Kuhlmann. The last chapter is a defense of the Binet method of testing intelligence against various critics, an exposition of his dynamic conception of intelligence, and a justification of the principles underlying Terman's revision and extension. The last paragraph attempts to prove that the advantages claimed for the Yerkes Point-Scale are questionable, that it has failed to equalize the "points," and that the employment of the intelligence quotient secures for the Binet Scale the advantages of giving partial credit for partial success.

An appendix of 16 pages contains tables giving the percentages that passed each test at each age. These tables might have been made even more valuable by stating in each case the number of subjects tested.

No psychologist, whether favorably or unfavorably disposed towards the methods of mentality testing, should fail to read this monograph, as it is by far the most important recent contribution to the problems of measuring intelligence. The topics treated are also of vital importance to teachers and educational administrators, and a widespread familiarity with this monograph should prevent many misuses of mental tests by persons not sufficiently acquainted with their true nature and significance.

L. R. G.

EDWARD STAFFORD JONES. *The Influence of Age and Experience on Correlations Concerned with Mental Tests.* Educational Psychology Monograph No. 22. (Edited by Guy Montrose Whipple.) Baltimore, Warwick & York, Inc., 1917, p. 89.

The avowed purpose of this monograph, as set forth by the author, is truly stupendous. It is an attempt to give answer to practically all those fundamental problems which confront the practical worker in the field of mental testing. The author makes an assay at answering the questions involved in the influence of age and experience on test performance, which answers, when correctly given, will tell us what in actuality the nature of potential development is, from which the plotting of the curve of age growth will become a simple matter. The significance of this will be sensed immediately by those who have had work in this field. Then, too, the question of a common factor in intelligence is necessarily implied in this study as well as other queries which the writer makes explicit.

There is a brief historical survey of the literature relative to each of the topics into which the work is divided. While this historical setting reveals no unanimity of opinion, it does enable the reader to get properly orientated for what is to follow. Here emphasis is justly laid on the necessity of knowing the conditions and of having them the same before a correlation is attempted. Also the effect of homogeneity and of heterogeneity within the group, on the coefficient of correlation, is made clear.

This is followed by a section on the administration of the tests used. The tests are described and the method of administering set forth. The arithmetical mean and the standard deviation is given for each test for each of the four years. The degree of correlation of the same test from year to year is indicated with explanations.

In the part dealing specifically with results, Dr. Jones has used the correlation method of attack and has given a various combination of single test with single test; of single test with total-test-average; of total-test-average with total-test-average; and of tests with school year completed. In the last case only partial correlations have been given.

The conclusions are a little disappointing but no more so than would naturally be expected. The problems to be solved are so fundamental in their nature that much investigation will need be done on them. However, considerable light has been thrown on the subject and the way made clear for further work. The specific value of the tests used, during the years covered, as to 'reliability' and as to 'stability' is a point of special merit. The conclusion that development at this time is in *content* rather than in psychological *process* is interesting. Dr. Jones finds no evidence of a common memory factor, nor of a common intelligence quotient. Lastly, the results seem to show that after the elimination of the 'instructions factor' experience tends to increase the correlation coefficient.

The monograph is a carefully done piece of work along lines difficult of attainment and, in addition to the positive results presented, prepares the way for other investigations along similar lines.

Cornell University. L. B. HOISINGTON.

WILLIAM A. WHITE. *The Principles of Mental Hygiene.* The Macmillan Company, New York, 1917, p. 323.

This work is a discussion of such social problems as insanity, crime, feeblemindedness, etc., from the psychoanalytic standpoint, and not only treats of the various factors which unite to create the asocial classes, but also outlines prophylactic measures. While very concisely written, the volume is comprehensive in its scope, including many social phenomena popularly regarded as outside the field of mental hygiene, as alcoholism, vagrancy, divorce, the woman movement, and other minor aberrant forms of social life. "It is the task of mental hygiene," says Dr. White, "to find less wasteful, more efficient means for dealing with these problems, and, when found, to urge such measures unceasingly upon those who make and administer our laws and direct the trends of public thought."

In the first chapters is a brief statement of some of the fundamental concepts of psychoanalysis, with the emphasis on the well-known Freudian flight from reality, which is later shown to be a leading motive in the types of conduct causing the social ills under consideration. "The instinct for the familiar—the safety motive" is the general term which is used to comprise such mental reactions as ambivalence and projection of emotions, the hysterical conversion downward from the psychic to the physical level, and other defence mechanisms. The genetic viewpoint is stressed throughout. "First of all, the great fact, it seems to me, which has always to be borne in mind, is the fact that our psyche bears the record of its hundreds of thousands of years' development within itself as truly as does our body. . . . This is the historical past of the psyche, the unconscious, it has been called, because its content, while a part of the psyche, is still not in consciousness."

The application of these general considerations to the specific problems of mental hygiene is, in some instances, unique, and in almost every case there are at least one or two significant suggestions. The discussion of the social attitude toward the criminal and the plan for a reform of the penal system is worthy of mention in this respect. The criminal himself has long been disregarded by society, and only the crime has been considered. It is the emotional reaction to the act,—the hatred of the crime,—which, projected upon the criminal, has been the unconscious motivation behind our stringent penal laws, which punish, but do not prevent repetition of the deed. If we are to treat this whole problem in a way leading to social efficiency, we must recognize and control this projection mechanism, and study the criminal with a view to finding and remedying the causes of his conduct. Instead of hard and fast rules for the treatment of each offense, the action toward the criminal must be modified in accordance with the findings of this searching analysis, which should determine whether he is a menace to society and must be imprisoned, or is a hopeful subject for more lenient reformatory efforts. Even those who are condemned, however, must enter a wholly different type of penal institution from that now in existence. The prison of the future will attempt to be constructive rather than destructive; to teach the prisoner a means of reaction at a higher social level instead of wreaking the vengeance of society upon him and creating in him an equal hatred which deepens his antisocial attitude.

In like manner, the treatment of the insane and of other pathological classes is outlined, with pertinent suggestions as to ways and means of prophylaxis. In one or two cases, the author departs radically from the generally accepted scientific attitude, and boldly states a wholly different point of view. In regard to the solution of the problem of mental deficiency, for example, he vigorously opposes the Eugenist plan of sterilization on the ground that it is based on an exaggerated statement of the excessive procreation of the unfit, and is a method utterly unsuited to a humane and sympathetic social organization. That the latter consideration is the real reason for his opposition to a solution which is increasingly advocated by science, is obvious from his own statement of his position: "I feel very much toward the question of sterilization as I do toward the proposition to chloroform all the insane and criminals. The dependents are the burdens which the efficient have to bear and become efficient in bearing. The pain and suffering they cause have 'forward ends' which make for a better and more humane society. Chloroform might be a solution, but I, for one, would not like to live in a society which adopted it."

The book is an excellent review of the pathological phenomena of present civilization from the sociological and psychoanalytic standpoints, and should prove valuable in spreading a broad general knowledge of the whole mental hygiene movement.

PHYLLIS BLANCHARD.

MAXIMILIAN P. E. GROSZMANN. *The Exceptional Child.* Containing a Medical Symposium with Contributions from a Number of Eminent Specialists. Charles Scribner's Sons, New York, 1917, p. 764.

The author uses the word "exceptional" in its broadest sense. "The purpose of the book is to give a perspective of the entire situation, and to suggest ways and means of coping with the problem in its various aspects." The first part deals with the problem of the individual child, the second part discusses the problem of clinical research and diagnosis, and the third part takes up the problems of prevention, adjustment, and organization. The author estimates that of the twenty-four million children of school age in the United States about six million, or twenty-five per cent, are healthy normal, while about twice this number "suffer from easily removable difficulties, including physical ailments." Of the remaining twenty-five per cent, eighteen per cent include "the exceptionally bright, the nervous, the difficult, the retarded child," five per cent include "the blind, deaf, crippled, arrested, economically submerged, and primitive groups," and the remaining two per cent or 480,000 include "the moral perverts and imbeciles, the feeble-minded, insane, etc." The author has somewhat modified the classification of types of children which he had proposed some years ago, but he still retains the three main classes of normal, subnormal and abnormal children, and clearly defines or describes each type. He divides the exceptionally bright children into four groups; "the *first group* consists of *children endowed with a good memory;* the *second group* comprises *those whose physical and mental growth is generally more rapid* than that of an ordinary child without pathological precocity; the *third group* consists of children of *one-sided development,* i. e., having one faculty, or group of related faculties, developed out of proportion to the other faculties; the *fourth group* is composed of those children in which *special or general excellency is associated with neuropathic and psychopathic tension.*" It is not at all clear to the reviewer why the first group should be set off from the third group. The author says: "the other three types involve intellectual faculties of an unusual character" (p. 107); evidently memory, in the author's view, is not an intellectual faculty In the chapter on the feeble-minded group (ch. 9, pp. 159-184) the author criticizes adversely the diagnosis of such cases by the Binet Tests and offers several valuable precautions to be employed in determining the mental status of a child. Concerning the efforts of standardization our author says: "the science of child testing is so very young yet that it would be disastrous if we should allow ourselves to be guided by a more or less mechanical scale, in placing a certain mental manifestation in a certain definite place of quantitative value, and judging a child accordingly. We may have to revise our standards continually on the bases of further experience. It is for this reason that we must use any kind of tests simply as systematized methods of approach and otherwise apply with fairness and common sense our own standards of experience and judgment" (p. 252).

The second part presents a rather lengthy discussion of the tests employed in the study of exceptional children with a strong emphasis upon the author's own methods of clinical treatment. Here the point of view of the surveyor has rather been lost sight of and frequently the lay reader is overwhelmed by the mass of technical details. On the whole the author's views are very sane and his criticisms of the Binet tests are made to the point. In the third main part, however, the author returns to his earlier perspective viewpoint and discusses such topics as legal provisions for various types of exceptional children, eugenic considerations, home life and home education, school problems, medical inspection, ungraded and special classes, institutional care, the sanatorium school, and the training of special teachers.

Appendix I is a discussion of "The City and her Boys" by Albert B. Hines of New York City. Appendix II is called "A Medical Symposium," occupying pages 562 to 706, and consists of twenty-five contributions of varying length by men like E. H. Arnold of New Haven, C. Ward Crampton, New York, Abraham Jacobs, New York, Howard A. Knox of Ellis Island, E. E. Southard, Boston, Ira S. Wile, New York, Tom A. Williams, Washington, D. C., Thomas D. Wood, New York, and others. In Appendix III are detailed first and second year data of P. E. G., and Appendix IV gives Specimens of Reports on Children Examined. A bibliography of nearly thirty pages concludes the work.

The author's style is lucid and non-technical. An especially attractive feature is the use of cases as illustrative material, while the sixty-three pictorial illustrations add further value to the text. The book may be recommended to all who desire an authoritative and comprehensive view of the numerous problems arising in connection with the exceptional child. L. R. G.

The following publications have been received:[1]

CHARLES HUBBARD JUDD. *Introduction to the Scientific Study of Education.* Ginn and Company, Boston, 1918.

J. E. W. WALLIN. *The Psycho-Educational Clinic and Special Schools.* Excerpt from Annual Report on St. Louis Public Schools, 1916-17, pp. 159-192.

Carry On, A Magazine on the Reconstruction of Disabled Soldiers and Sailors. Edited by the Office of the Surgeon General, U. S. Army. Published by the American Red Cross, 311 Fourth Avenue, New York City, vol. 1, No. 1, June 1918, pp. 1-32.

The Ohio State Institution Journal. Edited by Frank B. O'Bleness. Published by the Ohio Board of Administration, Columbus, vol. 1, No. 1, June 1918, pp. 1-84.

The Porto Rico School Review. San Juan, Porto Rico, vol. 2, No. 6, June 1918.

Report of the Commission on Military Training and Instruction in High Schools to the New Jersey Legislature, Session 1917. Reprinted by the American Union Against Militarism, Washington, D. C., May 1918, pp. 1-15.

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[1] Mention here does not preclude further comment.

NOTES

The Ohio Bureau of Juvenile Research, the first state bureau of its kind in the United States, has recently been established on a permanent basis by the Board of Administration. The position of Director of the Bureau has been accepted by Dr. Henry H. Goddard, formerly Director of the Department of Research at the Vineland Training School for Feeble-minded. He will be assisted by Dr. Florence Mateer and Miss Lucile A. Boylan. The Bureau will also employ several physicians, psycho-clinicians, teachers, field-workers, and caretakers, and will closely co-operate with the Department of Psychology at Ohio State University, with the Juvenile Court, and with the Ohio Institution for Feeble-minded. The Bureau was authorized by the State Legislature in 1913 and began its work July 1st, 1914, under the Directorship of Dr. Thomas H. Haynes; but until last year no provision had been made for housing it. Last year the sum of $100,000 was appropriated for buildings which are at present near completion. The functions of the Bureau are two: (1) to study, diagnose, and recommend treatment or proper institution for such cases as are sent in by the juvenile courts of Ohio, and (2) to study the causes of dependency and delinquency. The methods to be employed will be largely determined by the material to be studied, and will include besides the usual mental and physical examinations such more extensive and elaborate methods as X-ray examinations, physiological studies of digestion, secretion, excretion, and of the endocrine system and whatever else may be suspected of contributing to the causes of delinquency.

The Ohio Board of Administration, to which is entrusted the centralized management of all state institutions devoted to the care of the dependent wards of the state, began in June the publication of *The Ohio State Institution Journal*, under the editorship of Frank B. O'Bleness, Executive Clerk. This Journal is devoted "to the exposition of the work of the Ohio Board of Administration and the institutions under its control, in their efforts for the care and improvement of the dependent, defective and delinquent classes: to the publication of the results of researches into conditions responsible for these classes, and the best methods of treatment and prevention: and to the promotion of a complete understanding between the public and the above named agencies in order that both may work in harmony for the welfare of all." The first issue contains a most instructive account of several generations of the "Hickory Family" and its branches, by Miss Mina A. Sessions. This family takes pre-eminence among the defective families of a certain county surveyed "because of the fecundity of its members, the anti-social nature of their habits and mode of living, their utter dependency and the large amount of inbreeding which promises to perpetuate the defective traits."

The Office of the Surgeon-General, U. S. Army, has recently begun to edit and issue a new periodical, entitled *Carry On, A Magazine on the Reconstruction of Disabled Soldiers and Sailors*, which is published by the American Red Cross, 311 Fourth Avenue, New York City. The first number of volume one appeared in June and contains 32 pages. The Editorial Board consists of Colonel Frank Billings, M. C., N. A., Chairman; Lt.-Col. Casey Wood, M. C., N. A., Editor-in-Chief; Captain Arthur H. Samuels, S. C., N. A., Assistant Editor; John O'Hara Cosgrave; Herbert Kaufman; Lt.-Col. Harry E. Mock, M. C., N. A.; Douglas C. McMurtrie; and Charles J. Rosebault. The Advisory Board consists of twenty-eight members, among whom we find the names of Major-General William C. Gorgas, Honorable William Howard Taft, Samuel Gompers, President Harry Pratt Judson, Major William James Mayo, Rochester, Minn., Mrs. Mary Roberts Rinehart, Dr. Anna Howard Shaw, and Lt.-Col. William H. Welch, M. C., N. A. The first issue contains among others short articles by Douglas C. McMurtrie on "The High Road to Self-Support;" by Sergeant W. H. Zimmerman, A. E. F., on "Our First Blinded Soldier;" by Captain Arthur H. Samuels, S. C., N. A., on "Reconstructing the Public;" and an unsigned article entitled "The Enemy was Ready, How Germany Made Preparations for her Wounded." The magazine is well illustrated with photographs of various phases of the work on reconstruction.

The Staff of the Division of Physical Reconstruction in the office of the Surgeon-General, U. S. Army, contains, according to *Carry On*, among its members Dr. James E. Russell, Dean of Teachers College, Columbia University, Director of Educational Section, and Major M. E. Haggerty, S. C., N. A., Professor of Psychology, Indiana University.

The following is a partial list of members of the American Psychological Association who are engaged in national service of various kinds, including positions in the line, in the Sanitary Corps, in the Signal Corps, in the Aviation Service, in the Medical Reserve Corps, in the Y. M. C. A. work, as well as in civilian capacity. A complete list would probably show a 25 per cent enrollment in national service.

Abbott, E. Stanley, Major, M. R. C.
Angell, James R.
Arps, George F., Captain, S. C.
Ash, Isaac Emery, Captain, S. C.
Baird, John Wallace
Baldwin, Bird T., Major, S. C.
Basset, G. C., Captain, S. C.
Bentley, Madison, Captain, A. S., Sig. R. C.
Berry, Charles Scott, Captain, S. C.
Bingham, H. C., Lieutenant, S. C.
Bingham, W. V.
Boring, Edwin G., Captain, S. C.
Boswell, Foster P., Lieutenant, S. C.
Bridges, J. W., S. C.
Brigham, Carl C., Lieutenant, Tank Corps.
Burtt, Harold E.
Chapman, James Crosby
Chase, H. W.
Cobb, Percy W., Captain, M. R. C.
Dallenbach, Karl M., Captain, S. C.
Dearborn, George Van Ness, Lieutenant, M. R. C.
Dockeray, F. C.
Dodge, Raymond
Doll, E. A., Lieutenant, S. C.
Dunlap, Knight, Captain, S. C.
Edwards, A. S., Captain, S. C.
Elliott, Richard M., Lieutenant, S. C.
English, Horace B., Lieutenant, S. C.
Ferguson, G. O., Lieutenant, S. C.

Fernberger, Samuel W., Lieutenant, 304th Infantry.
Foster, William S., Captain, S. C.
Franz, Shepherd
Frost, Elliott Park, Lieutenant, S. C.
Haggerty, Melvin E., Major, S. C.
Haines, Thomas H., S. C.
Hall, G. Stanley
Hayes, Joseph W., Captain, S. C.
Henmon, V. A. C., Captain, A. S., Sig. R. C.
Hunter, Walter S., Captain, S. C.
Johnson, H. M.
Jones, Edward S., Lieutenant, S. C.
Kelley, Truman Lee
Kellogg, Chester Elijah, Private, S. C.
Kirby, T. J.
Kitson, Harry Dexter, Lieutenant, Field Artillery.
Metcalf, John T., Lieutenant, S. C.
Moore, Henry T., Lieutenant, S. C.
Morgan, John J. B., Lieutenant, S. C.
Myers, Garry C., Private, S. C.
Paterson, *Donald G., Lieutenant*, S. C.
Pechstein, Louis A., Lieutenant, S. C.
Pierce, Edgar A. B., Lieutenant, U. S. N. R.
Pintner, Rudolph
Poffenberger, A. T., Captain, S. C.
Porter, James P., Captain, A. S., Sig. R. C.
Prince, Morton
Rich, Gilbert J., Private, S. C.
Rowe, Eugene C., Captain, S. C.
Ruml, Beardsley
Russell, James E.
Scott, Walter D.
Seashore, C. E.
Stratton, George M., Captain, A. S., Sig. R. C.
Strong, Edward K., Jr.
Sylvester, Reuel H., Lieutenant, S. C.
Teachout, Robert B.
Terman, Lewis M.
Thorndike, E. L.
Thurstone, L. L.
Toll, Charles H., Lieutenant, S. C.
Trabue, M. R., Captain, S. C.
Watson, John B., Major, A. S., Sig. R. C.
Waugh, Karl T., Major, S. C.
Wells, F. Lyman, Captain, A. S., Sig. R. C.
Wells, George R., Captain, S. C.
Wembridge, Eleanor Rowland
Wheeler, Raymond Holder, Lieutenant, S. C.
Whipple, G. M.
Witmer, Lightner
Woodworth, R. S.
Yerkes, Robert M., Major, S. C.
Yoakum, Clarence S., Major, S. C.

Will members kindly inform the Managing Editor of any errors or omissions? A list of all psychological workers in national service is planned to appear in our next issue, and in order to make it as complete as possible information about psychologists engaged in national service is solicited.

COMMUNICATION

The following communication has been received:

GENTLEMEN:

In the JOURNAL OF APPLIED PSYCHOLOGY, Vol. II, 1918, No. I, p. 89, you print an article entitled "A Note on Mental Peculiarities as Symptoms in Stuttering." Will you be fair to the stammerers and print the other side of the case?

You will undoubtedly accept Dr. E. W. Scripture's testimony in regard to a fundamental fact as a basis for the discussion. He says, "If the question is asked of a patient in the fright stage, 'Why do you stutter?' he will answer, 'Because I am afraid that I will stutter.'"

Accordingly, there are two elements of the disorder to be considered, namely the fear of stammering, and the convulsive effort.

The fear originates in early childhood, in the period that precedes recollection and when the responsibility is entirely on the child's parents or guardians. Scripture, Blanton, Fletcher and others have explained the origin of that fear. An accident or incident interferes with the child's newly acquired and still unstable automatic speech, to overcome which interference the child makes a conscious speech effort, not realizing that its speech is now beyond the period of conscious direction. This conscious effort, being misdirected, blocks the child's normal speech and gives it an impression of inherent speech difficulty. Its companions laugh at its contortions and make it so uncomfortable that it acquires a fear of stammering, so it continues its efforts to avoid the stammering in order to escape the punishment.

If the child is mentally deficient because it is unable to perceive in infancy that it is impeding its speech, how much more deficient are those adult scientists who were unable to see that fact until Liebmann expressed it as an opinion, only, in 1914, and those scientists who are still unable to see it in 1918?

That the convulsive effort is the impediment and that it is voluntary, no one is excusable for not seeing. Who does not know that when the stammerer desists from the effort his normal speech asserts itself? Why is it that an authority will spend hours trying to demonstrate a mythical impediment when he can prove the real impediment in ten seconds? Let anyone do what the stammerer does —press his lips tightly together, hold his breath, exhaust his breath, press his tongue against his upper teeth or his palate, and so on— and he must see that the misdirected effort blocks the normal speech. To reject that evident impediment in search of another is as inadmissible and unscientific as to reject mutual attraction in search of an unknown cause of gravitation.

The child acquires this unfortunate habit of interfering with his speech. Society forces him to continue it. Parents make him talk on the principle that by talking he will overcome his fear; teachers make him stand up before a class and exhibit his infirmity, intensifying his affliction and infecting other pupils with it; employers expect the stammerer to conform to speech conventions injurious to him; even the agencies represented to benefit him—the stammering schools, clinics, and so on—teach him the breathing and articulatory exercises which Liebmann, Thorpe and innumerable subjects of those treatments have testified to result in intensified stammering outside the environment of the cure. This unjust and cruel treatment of the stammerer accounts for all his peculiarities, to wit:

"*Brevity—short answers and short sentences.*" Under conditions of special embarrassment he has had difficulty with certain sounds, so he fears those sounds and consequently stammers on them. In long speeches he would surely encounter some of them and consequently encounter difficulty, so he is brief.

"*Sensitiveness.*" He has been ridiculed and pointed out as a defective. He sees people watching him to witness his next contortion. He is shunned by people who find his affliction distressing or dangerous. He is misunderstood because he can not express himself and because he is judged by standards that are unjust to him. Who among his critics—rational critics—would not be sensitive under those conditions?

"*Self-consciousness.*" What makes self-consciousness but undue attention? Society is to blame for that: not the stammerer. The ticket-agent snaps at him, "Well, what do you want?" and the line of travelers stares at him. The people in the trolley car stare over their papers at him as he tries to ask for his transfer. Society makes him self-conscious and then calls him defective because he is what they have made him.

"*Undue speed in speech.*" The beginning of an utterance is generally the most difficult part for the stammerer; so, when he gets his normal speech going he tries to keep it going. He is merely endeavoring to avoid his impediment in order to avoid humiliation.

"*Uninhibited speech.*" Many authorities give inhibition as the stammerer's trouble. Comment may wait until agreement on the subject is reached.

"*Confusion of thoughts.*" Anyone may be called on to speak before his thoughts are collected and in that circumstance the stammerer's difficulty is enhanced because to the doubt of speech ability is added the doubt of what to say. Ordinarily, however, the stammerer's thoughts are clear, before he encounters difficulty; for he has formulated them sometimes days, weeks or months ahead. But when he encounters difficulty he must think quickly in order to avoid it. If he can not think quickly enough he becomes confused, not as to what he wants to express but as to suitable words which he is able to utter. If he fails, his confusion is due to the humiliation, past or present, which society accords him.

"*Early and quick onset of fatigue in mental processes.*" Yes. The mental labor of circumventing the memories of thousands of humiliating speech failures is prodigious, and therefore exhausting. That is one of the many reasons why school children should be excused from oral work. The mental effort which should be spent on the acquisition of an education is spent in plans to circumvent the recitation-room torture.

"*Unsociability.*" Society—not the stammerer. One of his great, unsatisfied longings is for understanding and sympathetic society.

"*Taciturnity.*" Yes, especially in adult life. Forced to form and reform the anticipated expression of his ideas, he abandons much of the useless and unimportant. Realizing that the childhood care which would have saved him from a life of suffering has been kept from him by an impossible barrier of speculation, he does not feel affection for those persons or agencies which sacrifice the happiness of hundreds of thousands of human lives for a little notoriety or a few paltry fees.

"*Despondency.*" Melancholia and suicide, too.

"*Reticence.*" Retention of what can not be uttered.

"*Self-repression.*" Without the "self." Excepting the black slaves, and not excepting either the white slaves or the factory children, there is probably no other great class (1,000,000, in this country) so oppressed as the stammerers. The deaf, the lame, the blind, the sick, the impoverished, the wage earner—every such class has agencies and influences working for it. The stammerers have no organization, no publication. The limited portion of the educational, scientific and medical press which considers the subject is devoted almost exclusively to disease theories of the disorder and to the mythical cure and is practically closed to prevention and early correction. The private stammering-schools have been justly and repeatedly condemned, yet their methods are adopted in the public schools. Even the speech clinics practice the injurious treatments. The general press excludes the beneficial information about stammering because it is not of general interest, but prints the harmful sensations because they are of general interest. The innumerable agencies for the protection of the child are deaf to the pleas of the little stammerer, and by their apathy maintain the conditions which force that child into what Dr. Scripture calls a living death.

Will you do the stammerer the scant justice of printing his view that the charge of "Mental Peculiarities"—and some other peculiarities—belongs elsewhere.

Sincerely,

ERNEST TOMPKINS.

THE
JOURNAL OF APPLIED PSYCHOLOGY

VOL. II DECEMBER, 1918 No. 4

THE MENTALITY OF A GIFTED CHILD

By GENEVIEVE L. COY, Ohio State University

In a recent number of this Journal, an article entitled, The Psychology of a Prodigious Child[1], reported the remarkable scores of a boy of eight years, in several mental tests. The concluding sentences of this article are as follows: "The data here collected are of significance in that they show how far it is possible for a child to vary from the norm in the direction of superior intelligence. They also suggest the value of studying the psychology of precocious children, so that we may advance our science to a point where we shall be able to prognosticate concerning them."

Such a study would undoubtedly include the reports of the mental tests applied to gifted children, observations of the children's behavior at home and at school, a survey of the quality of the school work done by these children, etc. After a number of records of gifted individuals are obtained we may continue the study by an analysis and comparison of records, which may lead in time to the formulation of a "psychology of gifted children."

The purpose of the present article is to report the mental test scores of a girl of ten years of age, whose excellent record entitles her to the term, "gifted child." Some observations on her school work and extra-school activities will be added in the effort to make the "picture" of the child as complete as possible.

The circumstances which led to this study will be of interest to those who are concerned with the problem of the school training of gifted children. During the school year 1916-17 a class for "bright" children was conducted in one of the public schools of Urbana, Illinois. The organization of such a class was due to the effort of Professor Guy M. Whipple, of the University of Illinois, and the work of the class was carried on under his direction. As research assistant to Professor Whipple, the writer of the present article gave various educational and psychological tests to the children of the "Gifted Class." The children were selected by the teachers of the fifth and sixth grades in the school; and the basis of selection was, in large part, the schoolmarks of the previous year. Fifteen fifth-grade and fifteen sixth-grade children composed the "Gifted Class." The average Binet Intelligence Quotient of the fifth grade was 119.3 and of the sixth grade, 115.9. The range of the I. Q.'s in the group of thirty children was from 99.3 to 146.6. In the teaching of both grades an effort was made to cover ground as rapidly as possible, without overworking the majority of the children. As a result, four-fifths of the group completed two years of school work in the school-year 1916-1917.

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[1] C. C. Garrison, A. Burke, L. S. Hollingworth. The Psychology of a Prodigious Child. *J. Applied Psych.*, 1917, Vol. I, p. 101.

In the same school building were three other rooms containing fifth and sixth-grade pupils. During January and February, 1917, a number of mental tests were given to these children, in order to obtain scores to compare with the scores of the "Gifted Class." In the course of this testing one fifth-grade girl made such excellent records that the experimenter became interested in her, and examined her scores with special care. As a result, it was found that she ranked above the average for the Gifted Fifth Grade in 10 out of 14 group tests. Because of this record, it seemed wise to give her a Binet Test, which was administered on January 30, 1917. To the amazement of all those who were interested in the "Gifted Class," the Stanford Binet I. Q. of this fifth-grade girl, M. F., was 167! At the time of the test she was 9 yr. 10 mo. old, but her mental age was 16 yr. 5 mo. In the course of the test, the examiner learned that M. F. had never been in school until she entered the fifth grade in September, 1916. Before that time she and her younger sister had been taught at home by their mother. M. F. had therefore had no "last year's school marks" which teachers and principal might consult. As a result she had not even been considered as a possible candidate for the "Gifted Class."

In January, 1917, the fifth-grade teacher reported that M. F. did practically the best school work in the class of forty children. On March 1, 1917, M. F. was transferred to the fifth-grade group of the "Gifted Class," which had then covered all of the fifth-grade work and about one-third of the sixth-grade work. In June, 1917, M. F., with several others in this group, was promoted to the seventh grade. At that time the teacher of the "Gifted Class" ranked M. F. as *second* in the fifth-grade group, in quality of school work. In September, 1917, she entered the Urbana Departmental seventh and eighth-grade school. The seventh grade is divided into six or seven sections, according to the quality of work done by the children. M. F., who was then 10 yr. 5 mo. old, was placed in the highest section of the seventh grade. Since the normal age for commencing seventh grade is 12 years, M. F. is one and one-half years younger than the average seventh-grade child. But when we consider that mentally she is at least 16 years of age, we conclude that she is capable of doing more advanced work than the average seventh-grade child. She could doubtless do both seventh and eighth-grade work with as little effort as that used by the majority of children in doing seventh-grade work alone.

A more detailed account of the results of the Binet Test follows: The Stanford Revision of the Binet Test was given following the instructions in L. M. Terman's "The Measurement of Intelligence." M. F. passed *all* the questions in the 12 year group. The credit given above that group was as follows:

14 yr. group	20 mo. credit
16 yr. group	15 mo. credit
18 yr. group	18 mo. credit

In the Vocabulary Test, M. F.'s score was 52 words, which gave her credit for that test in the 14 yr. group. Samples of her responses are as follows:

Regard,—to regard something is to look at it with interest.

Brunette,—a brown haired girl; it's the opposite of blonde.

Insure,—to make safe; you insure your furniture with the insurance company.

Most of her definitions were given in simple words, but she showed clearly that she knew what the terms meant.

In Year XII, Test 2, Abstract Words, 3 out of 5 words were defined correctly. The two words failed were *pity* and *justice*. *Revenge* was defined as, "when some one has done something to you, you want to do something to pay them back." *Charity* was defined as "being good to the poor; giving them things and not treating them cruelly."

In Year XII, Test 4, Dissected Sentences, all parts were answered correctly, with time-scores of 20, 7.5 and 9 seconds, respectively.

Her record in the Fable Interpretation, Year XII, Test 5, was comparatively low. Her score was 4:—2 points credit on "Hercules and the Wagoner," and 2 on "Maid and Eggs." Wrong responses in this group were, in the case of "Fox and Crow," "not to be greedy;" in the case of the "Farmer and Stork," "not to harm people that have done you no harm."

In Year XII, Test 7, Picture Interpretation, satisfactory responses were given to all except the Post Office picture. Her interpretation of the Colonial Home was, "The girl is crying because the man is her lover and he is going away because she has done something that makes him dislike her."

In Year XII, Test 8, Giving Similarities, all five questions were answered correctly.

In the tests of Year XIV, the only group failed was Test 4, Problems of Fact, all three parts of which were incorrect. In the Induction Test, the rule was given after the fifth folding. Her response to the President and King Test was as follows:

"The king doesn't let the people have any hand in the laws and the president does. The President rules a republic and the King rules a monarchy. We elect any man we want for President every four years. A King is king as long as he lives and when he dies some relation of his is King."

In Year XIV, Test 5, Arithmetical Reasoning, two out of three problems were correct. The exact responses were: (1) 50 weeks (given in 29 seconds); (2) 5 pencils (in 7 seconds); (3) 35 cents (in 37 seconds). In Test 6, Reversing Hands of Clock, two out of three were correct. The time-scores were 9, 11 (incorrect) and 18 seconds, respectively.

In Year XVI, the Vocabulary Test, the Intepretation of Fables and the Differences between Abstract Words were failed. In Test 4, Problem of Enclosed Boxes, 3 out of 4 were correct. The responses were as follows: (a) 5 (given in 4 seconds); (b) 7 (in 9 seconds); (c) 10 (in 4 seconds); (d) 21 (in 21 seconds). In Test 6, the Code, two errors were made; the total time for the test was 118 seconds. Since the time allowed for this test by Terman is 360 seconds, the record made by M. F. is an excellent one.

In year XVIII, Test 2, Binet's Paper Folding Test was done correctly. Credit was also given for Test 4, Repeating the Thought of a Passage Heard. The first selection was not given correctly since her reply contained only the following statement, "Tests such as are now given are for both the advancement of science and the information of the person who is tested." Her response to the second selection was as follows:

"Two opinions are given of the valuableness of life. Some think it good, some think it bad. But it should be called mediocre. Our happiness is never so great as we should wish it, and our misfortunes are never as great as our enemies would wish us."

Test 6, the Ingenuity Test, was failed, for she was able to do only one of three correctly.

M. F.'s record in repetition of digits was as follows:

Repeating	6	digits		2	right	in	2	trials
"	7	"		1	"	"	2	"
"	8	"		0	"	"	3	"
"	5	"	backwards	2	"	"	3	"
"	6	"	"	1	"	"	2	"
"	7	"	"	2	"	"	3	"

That is, the only test in memory for digits which she did not succeed in was the Year XVIII test for 8 digits.

A survey of the results just reported shows that M. F. has excellent ability in seeing abstract relationships, in language, in rote-memory and in logical memory. She also does remarkably well in tests which involve the ability to deal with objects "not present to sense." This is evidenced by her records in the Clock Test, the Code, and the Enclosed Boxes. The most surprising *failures* are in the Problems of Fact and the Interpretation of Fables. In general, M. F.'s responses were not in the least *spectacular*. The remarkable thing about her performance was that all questions were answered with an ease, a definiteness and a reasonableness, which are very rarely found in a 10 year old child.

It should perhaps be noted that all answers in the Binet Test were recorded verbatim, and the records were scored by two people who had had experience in using the tests. Both scorers agreed in counting M. F.'s mental age as 16 yr. 5 mo.

In the course of the study of the "Gifted Class" other individual and group tests were given to M. F. A report of a few of these tests will serve to substantiate the results of the Binet Test. On February 8, 1917, the Analogies Test[2] was given to M. F. Her total time for List C was 230.4 seconds. Comparing this record with a Percentile Table given by W. S. Miller, in "Mental Tests and the Performance of High School Students," we find that M. F.'s record reached the 50th percentile for High School Juniors. We may therefore conclude that in ability to see relationships of the type given in the Analogies Test, M. F. does as well as would be expected of the average girl of 16 years of age.

On February 23, 1917, M. F. did the Hard Directions Test[3].

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[2] Whipple, G. M. *Manual of Mental and Physical Tests,* Vol. II, Test 34A.

[3] Woodworth and Wells. *Association Tests,* pp. 69-74.

Her score, in terms of "accuracy divided by time," was .769. Comparing this with percentiles given by W. S. Miller, we find that she reaches the 64th percentile for High School Seniors.

In the Marble Statue Memory Test[4], on February —, 1917, M. F. made a score of 37 "ideas" correct. Comparing this with norms given in Whipple's *Manual of Mental and Physical Tests,* we learn that she reaches the average for 16 year old girls. This would tend to verify the results of the Binet Test, which showed that she had an excellent logical memory.

In the Trabue Language Tests B & C, M. F. made a total score of 32. Comparing this with the standards given in "Completion-Test Language Scales," by M. R. Trabue, this score falls halfway between the median for High School Juniors and Seniors. Trabue now has evidence to show that the norms given in the book just mentioned are too low, and that the norm given for Seniors should be given for Juniors, etc. M. F.'s record is therefore probably about that of the average student at the beginning of his Junior year in High School.

The results of the four tests just discussed show that in certain mental abilities M. F., at the age of 10 years, could do as well as the average child of 16 years. This agrees remarkably well with the results of the Binet Test.

The results of other tests may be given more briefly. The standards used for comparison are Percentile Tables based on the records of 70 sixth-grade children in Urbana, Illinois. The results of several tests are here grouped, and one percentile is given for the group.

In Visual Vocabulary, M. F. reaches the 78th percentile for the 6th grade.

In Understanding of Sentences Read, M. F. reaches the 62nd percentile for the 6th grade.

In Arithmetical Computation, M. F. reaches the 50th percentile for the 6th grade.

In Drawing Designs, M. F. reaches the 96th percentile for 6th grade.

In tests of ability to deal with spatial relations, M. F. reaches the 90th percentile for 6th grade.

In tests of reasoning ability (such as the Bonser Reasoning Tests), M. F. reaches the 91st percentile for 6th grade.

The foregoing tests tend to show that while M. F.'s native ability is remarkably high, her lack of training in school work causes her records in tests of educational achievement to be comparatively low. The fact that she did complete two years of school work in one year shows that she is capable of responding readily to the demands of school life. We have every reason to believe that she is capable of advancing in school almost twice as rapidly as the ordinary child.

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[4] Whipple, G. M. *Manual of Mental and Physical Tests,* Vol. II, p. 209.

Since M. F. covered the first four years of school work under her mother's teaching at home, an account of her mother's methods of teaching will be of interest. The following is quoted from a letter from M. F.'s mother: "My theories in teaching M. F. consisted chiefly in trying to let her mind develop as it would. I tried to follow out with her her own inquiries that came up in the course of her reading and geography, and never to check her in her efforts to think things out as far as she would. In arithmetic which I had to give her in order to have her fit into the System later, I had her do as much mentally as possible and to show her reasons where I could. I had her learn some poetry and used it for spelling and for writing practice. And we always try to answer truthfully and respectfully the children's questions and to encourage their observations with things out of doors and facts of nature."

It is especially interesting to note that M. F. seems to be thoroughly normal in all her social reactions. She plays with other children of her own age or a little older, and seems to enjoy their games, such as jumping rope, jack-stones, etc. She might be described as a "tom-boy." She is quite likely to run at full speed after a boy of her own age, shouting that she will pull his hair when she catches him! One of her boy playmates said of her, "Oh, M. F. is as good as a boy to play with, any day!"

On the other hand, she reads a great deal; and the following are among the books she enjoys: Little Women, Little Men, Under the Lilacs, Eight Cousins, Pollyanna, Penrod and Sam, Hans Brinker, Treasure Island, Fairy Tales Every Child Should Know, Norse Myths, Beasts of the Field, St. Nicholas. She is interested in the study of birds, and knows a great deal about their appearance, cries, nests, etc. At home she helps her mother by setting the table. Sometimes she sews for her dolls, but as a rule she "doesn't care for sewing." She wants to travel so that she can see all the "interesting parts of the United States." She would like to be a teacher of Music or Drawing "when she grows up."

The following facts about M. F.'s family-history have been obtained:

Paternal grandfather: Methodist circuit-rider; great reader; largely self-educated.

Father: Early education in a country school; attended Academy and College of Northwestern University; Ph. B. in 1895; was a working student earning own way; did excellent work; special interest in economics, political economy, German; was told that he failed of election to Phi Beta Kappa because he had not majored more definitely in some one subject. Took a two years course in Albany Library School; one year legislative assistant in State Library. Was characterized by one of his classmates in the Library School as the "thinker of the lot." He is at present at the head of a large department in the University of Illinois, with a large staff of people working under him.

Maternal grandfather: A man of "real intelligence;" a great reader; an expert accountant.

Mother's oldest sister: Highest rank in her class in High School; took architectural course at Cornell University; elected to Sigma Xi.

Mother's younger sister: Highest rank in her class in High School; led her class in Medical College at University of Michigan.

Mother: Entered High School at 13 yrs. of age; highest rank in her class in H. S. Entered Cornell University on state scholarship from assembly district; at end of second year was awarded university scholarship on basis of grades for first two years. Elected to Phi Beta Kappa in Junior year and to Sigma Xi in Senior year. Degree of Ph. B. in 1895. Chief interests in college were in natural sciences. Had a year of graduate work, on a graduate scholarship, in botany and entomology, in 1896-97.

M. F.'s older sister was 13 years of age, in June, 1917. In September, 1917, she began the second half of the first year of High School work. She is therefore advanced in school a year and a half beyond the average child of her age. The results of a Stanford-Binet Test, given on November 12, 1917, are as follows: Age, 13 yr. 5mo.; Mental Age, 18 yr. 1 mo.; Intelligence Quotient, 134.8. She passed all the 14 yr. tests; all but one of the 16 yr. tests; and four of the 18 yr. tests. Her most remarkable score was in the Vocabulary Test in which she made a record of 77 words correct,—more than enough to pass the Superior Adult standard. This indicates that she has a vocabulary of nearly 14,000 words. Her mother describes her as an "omnivorous and rapid reader."

M. F.'s younger sister was 8 yr. of age, in June, 1917. The results of a Stanford-Binet Test given November 13, 1917, are as follows: Age, 8 yr. 5 mo.; Mental Age, 8 yr. 6.8 mo.; Intelligence Quotient, 101.8 She passed all of the 7 yr. tests, 5 of the 8 yr. tests, 2 of the 9 yr. tests and 2 of the 10 yr. tests. Her mother taught her at home until she was 7 yr. 4 mo. of age. She then entered the first grade, and covered the work to the middle of the 2nd grade in 1916-17. In the fall of 1917, she was not well and her mother kept her out of school and taught her at home. She does not enjoy reading and studying as her two sisters do. She has trouble with her eyes, which an eye-specialist says is a "nervous trouble" which prevents her from focussing correctly. Her adenoids and tonsils were removed in the summer of 1917. She seems rather immature for a child of eight and a half years, but this may be due to her lack of experience with other children in school, and to the fact that her general ill health has caused her parents to "baby" her a little. It is possible that the I. Q. of 102 is too low, and a Binet Test given two or three years hence, after she has had more school work, may give an I. Q. of 105 to 110.

These facts concerning M. F.'s family history indicate that she has received a remarkably good combination of traits *from an exceptionally gifted family.*

The foregoing discussion contains the most interesting and valuable results of our study of M. F. We may summarize our impressions of her as follows: She is an attractive, merry, wholesome girl, who does all mental work with an ease, accuracy and expertness, which entitles her to be called a "*gifted child.*"

THE RELATION OF MENTAL AGE TO CHRONOLOGICAL AGE AS DETERMINED BY CERTAIN INDIVIDUAL AND GROUP TESTS

By J. E. Evans and Margaret Castle, Ohio State University.

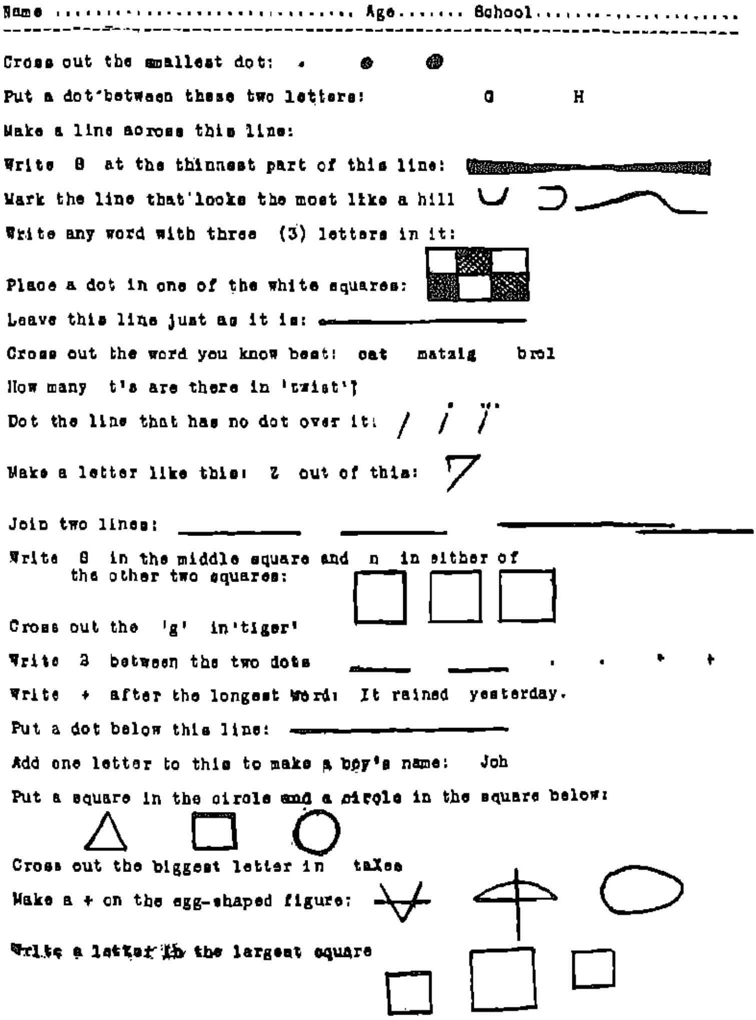
There is the current opinion that the mental age of an individual as determined by our best standardized mental scales is an exact representation of his ability to react to educational problems, no matter what his chronological or physical age may be. Thus a child who is 9 years old mentally and 12 years old chronologically will, it is assumed, react to his environment like a normal 9 year old child.

If the present mental tests furnish a reliable index to mentality then educators need have no fear in using the results of the best standardized mental tests as a basis for their classification of pupils. But some educators are still in doubt as to whether our tests measure that type of mentality needed for advancement in our educational system. If such does not prove to be the case then either the tests must be more fully standardizez, or they must be elaborated and made more extensive so as to include such material as will afford an index to (educational) mentality, or they must be disregarded for purposes of classification and promotion in school.

Description of the Groups of Subjects

From a large group of more than 400 children who had been tested during the year by the Yerkes-Bridges Scale two small groups were selected. This selection included all the children who could be included in the groups described below. One group was designated the 'normal group' and consisted of 15 cases with both a mental and chronological age between 8.5 and 9.5 years. In this group of 15 cases there were 7 boys and 8 girls. Of these, two were colored. In the second group, termed the 'abnormal group,' there were 19 cases. This group had a mental age of 8.5 to 9.5 years but a chronological age different from this. In 3 instances the chronological age was less than the mental age. The chronological age ranged from 8 to 15 years with a median age of 11.8 years. There were 10 boys and 9 girls. Of these 7 were colored children. Thus the two groups represented a chance selection. The C. M. A. of

PLATE I.



Name .... Age....... School.......................

Cross out the smallest dot:

Put a dot between these two letters: G H

Make a line across this line:

Write 8 at the thinnest part of this line:

Mark the line that looks the most like a hill

Write any word with three (3) letters in it:

Place a dot in one of the white squares:

Leave this line just as it is:

Cross out the word you know best: cat matzig brol

How many t's are there in 'twist'?

Dot the line that has no dot over it:

Make a letter like this: Z out of this:

Join two lines:

Write 8 in the middle square and n in either of
the other two squares:

Cross out the 'g' in 'tiger'

Write 3 between the two dots

Write + after the longest word: It rained yesterday.

Put a dot below this line:

Add one letter to this to make a boy's name: Joh

Put a square in the circle and a circle in the square below:

Cross out the biggest letter in taXes

Make a + on the egg-shaped figure:

Write a letter in the largest square

the abnormal group ranged from .53 to 1.28 with a median of .82; for the normal group the range was from .89 to 1.44 with a median of 1.10.

The children in both groups attended the public schools.

About one-half of the cases in the 'abnormal group' were in special public schools or classes for exceptional children.

A series of 6 group tests and a series of 4 individual tests were used. The following is the list:

- Group tests—
  - Direction tests.
  - Easy opposite test.
  - Memory for forms.
  - Letter square method.
  - Cancellation (9's).
  - Number checking test.
- Individual tests—
  - Puzzle test (heart and clevis).
  - Terman's "ball and field test."
  - Thurstone's hand test.
  - The tapping test.

General Description of the Tests

A. Group Tests

1. *The Direction Test.*—The direction test sheet is shown in Plate I. The test was modified by the authors from the Woodworth and Wells direction test. The child was told to do what the paper told him to do. While no time limit was set about 10 minutes was allowed to complete the test. For each direction properly carried out 1 point was allowed. A maximal score of 23 points was possible.

Table I represents the work of the two groups in the direction test.

Table I

Direction Test

Cases	Av. No. right	Av. No. wrong	Av. No. omitted
(Normal Group)			
15	17.0	1.7	4.6
	A. D. 4.6	A. D. 1.2	A. D. 4.7
(Abnormal Group)			
19	17.0	4.3	5.2
	A. D. 4.8	A. D. 2.0	A. D. 4.4

The great similarity of results for the two groups suggest that the direction test is a very good test of mentality.

2. *Opposite Test.*—The opposite test was composed of a list of 49 words. The list was easy or of medium difficulty. The words are given in Plate II. Directions were printed at the top of the list. These were read to the children and the

meaning of an opposite explained and illustrated. Not more than 10 minutes were allowed the child in which to complete the list. A score of 1 point was allowed for each correct opposite given.

PLATE II

Name................ Age last birthday...... Boy or girl........
Date........ School........ Date of birth........ Grade........

After each of these words write a word or expression which means just the opposite. Do not use the same word with the word 'not' before it.

yes
take
up
wet
tall
top
to
white
thin
war
add
buy
big
brother
come
above
asleep
dirty
east
day
open
over
soft
slow
sick

dead
dark
empty
early
good
front
first
give
few
go
far
glad
hot
happy
heavy
here
high
in
love
new
north
out
push
rich

Table II represents the achievement of the normal and abnormal groups.

TABLE II

(Normal Group)

Cases	Av. No. right	Av. No. wrong	Av. No. omitted
15	36.5	10.0	5.3
	A. D. 6.9	A. D. 3.0	A. D. 5.6

(Abnormal Group)

Cases	Av. No. right	Av. No. wrong	Av. No. omitted
19	11.7	12.4	25.5
	A. D. 7.7	A. D. 6.1	A. D. 9.8

3. *Recognition Memory.*—In the memory test for forms two sheets of forms were used. (See Plate III). These sheets were modified by the authors from the Thorndike sheets. The small sheet contained 25 different forms and the

PLATE III A

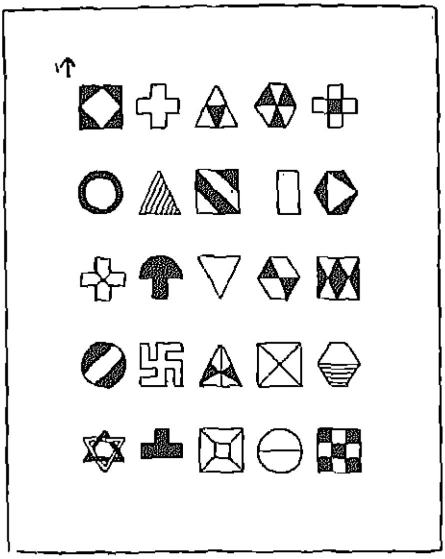
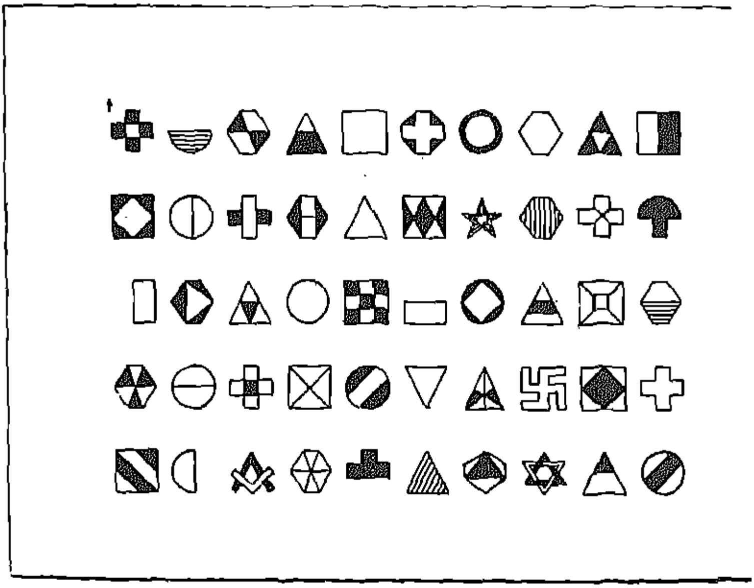


PLATE III B



large sheet the same 25 forms distributed at random among 25 additional forms for confusion purposes. The children were told to study carefully the forms on the smaller sheet for 2 minutes and then to mark on the large sheet those forms which they had seen on the smaller sheet. No time limit was set although about 5 minutes were found to be sufficient for marking the forms remembered.

In scoring the sheets 3 points were allowed for each form correctly remembered. A discount of 3 points was made for each form crossed which did not occur on the smaller sheet, and a discount of 1 point was made for each form omitted. This method was determined empirically on the basis of records from 33 adult subjects which gave a ratio of 3 correctly marked, 1 omitted, and 3 incorrectly marked. This method gives better results than the method which requires the subject to mark 25 forms by guessing at the few not actually remembered.

By this method the subject would obtain a score of 0 if the 50 forms were all marked without any memory functioning. The maximum score would be 75 points, the minimum score possible would be —100 (25 correct forms omitted and 25 confusion forms incorrectly crossed). The range then would be from —100 to +75. It is very rare to find a normal subject who makes a score of 0 or below.

Table III shows the results of the test for the normal and abnormal groups respectively.

TABLE III

	Normal	Abnormal
Av.	27.6	—2.
A. D.	1.1	—2.3
Median	29	—1.0

4. *Letter Square Method.*—As a formal memory test the letter square method consisting of a set of 4 cards was used. Each card contained 12 letters. All collocations so far as possible were avoided. Each card was exposed for 25 seconds. The children then placed the proper letters in the blank squares previously provided for them.

In grading the test the method of Winch[2] was followed. Three points are assigned for each letter in its right position, 2 for each letter one position removed to the right or left, or above or below its right position, and 1 for each letter two removes to the right or left, or above or below. A maximum score of 36 was possible.

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[2] Winch, W. H., *Brit. Jour. of Psychology,* Vol. 1, 1904, p. 126.

PLATE IV

1.

Z	R	Y	H
K	F	Q	N
P	J	V	T

2.

W	K	G	X
C	Y	T	B
M	H	R	L

3

X	D	T	M
N	Y	L	V
R	B	Z	S

4

M	F	Y	C
Z	Q	N	S
D	J	X	B

TABLE IV

Letter Square Method

	Normal	Abnormal
Av.	14.8	12.2
A. D.	4.6	2.9

5. *Cancellation.*—In the cancellation test the digit 9 was cancelled from a sheet containing 1000 mixed digits. Two minutes were allowed for the cancelling.

The formula $A = \frac{c-w}{c+o}$ was used to determine the accuracy of the work. For determining the efficiency of the work, E=SA was used[3] in which:

A=index of accuracy,
o=number of letters erroneously omitted,
c=number of letters crossed,
w=number of letters wrongly crossed,
E=desired efficiency index,
S=speed index (time used).

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[3] Whipple, Manual of Mental and Physical Test. 'Single volume,' p. 260, 1910.

TABLE V

Cancellation

Normal No. of 9's cancelled		Accuracy	Efficiency
Av.	38.6	78.1	2.3
A. D.	9.1		
Abnormal			
Av.	26.5	79.2	1.9
A. D.	8.1		

6. *Number Checking Test.*—The number checking test consisted of a sheet of numbers from 1 to 50 arranged in a mixed order. (See Plate V). The child was told that all the numbers from 1 to 50 were included on the sheet and that he must begin at the small circle in the upper left hand corner of the sheet and then with his pencil make a line to 1, then to 2, then to 3, and so on, for all the other numbers in regular order till the signal to stop was given. Every number in its regular serial order must be connected. Two minutes were allowed for the test. The individual who reached the highest number was ranked highest in the test. Table VI gives the results of the test for the two groups.

TABLE VI

Number Checking Test

Group	Cases	Median No. reached	A. D.	Failures
Normal	15	11	7.1	4
Abnormal	17	12	5.1	6

By failures we mean those children who for some reason failed to follow directions. Skipping a number or numbers, reading a number incorrectly as 31 for 13 were some of the common mistakes.

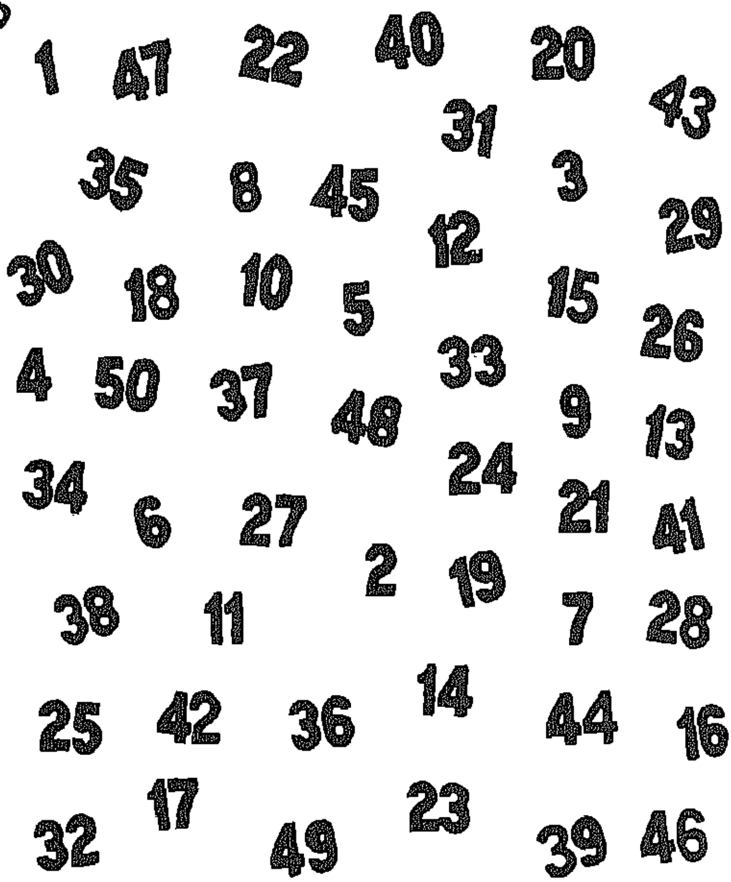
B. Individual Test

1. *Mechanical Puzzle.*—Probably no mechanical contrivance on the order of a puzzle is as simple as the heart and clevis puzzle which consists of a heart shaped piece, a clevis, and a bolt. All parts were made of wire. By inserting the loop on the heart in either of the two loops on the clevis and turning the bolt the puzzle is solved. Only three moves are necessary to solve the puzzle. So simple are these moves that the two parts of the puzzle sometimes drop apart when the subject is handling it. This puzzle was selected on account of its simplicity. The child was told that the two parts of the puzzle were to be separated, and the two parts were shown separated. He was allowed then to handle the puzzle for 3 minutes; but no one really used this much time.

Of all the individuals in the two groups only one person

PLATE V

Name............. Age last birthday........ Date of birth........
Date........ Grade or class in school........ Boy or girl........
Time used........... Number reached....... Remarks............



(of the normal group) showed any comprehension of the test, but not a single child succeeded in solving the puzzle.

2. *Ball and Field Test.*—As a second ingenuity test the Terman (8 years old) 'ball and field test' from the Stanford Revision of the Binet test was used[4]. The longest time used was 3 minutes and 30 seconds. The normal group included 1 successful solution and 14 failures, the abnormal group had

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[4] Terman, The Measurement of Intelligence, 1916, p. 210.

3 successes and 15 failures. In all these successes no one was above Terman's lowest standard.

3. *The Thurstone Hand Test.*—The Thurstone Hand Test consisted of a series of pictures of right and left hands in various positions arranged in a chance order on the page. The page was presented to the child, and he was directed to begin with the first hand and tell whether the pictures represented a right or a left hand. The child was allowed his own time but any undue hesitation was treated as a failure and he was told to pass to the next picture. Table VII gives the result of the test for the two groups. One point was allowed for each success. It seems to the authors that the test allows the child to guess and still make a high grade. For example, if the child starts by saying right, left, right, etc., for each row and there is a strong tendency to do this, he can make a grade of 26 points out of a possible 49 points.

TABLE VII

Thurstone Hand Test

	Normal	Abnormal
No. wrong		No. wrong
Av.	19.6	18.9
A. D.	6.3	3.3
No. correct		No. correct
Av.	29.3	25.9
A. D.	6.9	2.4

4. *Tapping Test.*—For the tapping test the regular tapping board and electric counter with 3 dry cells were used. Each child tapped for 2 minutes and the counter was read at the end of each minute. Table VIII shows the achievement of each group for the right and left hand at the end of the first and the second minutes.

TABLE VIII

Tapping Test

Rt. Hd. 1st min.	2nd min.	Lft. Hd. 1st min.	2nd min.	Index of Right handedness
		Normal Group		
251	229	207	204	1.17
A. D. 21.3	43.1	31.1	27.0	
		Abnormal Groups		
243	230	229	221	1.05
A. D. 33.1	45.6	38.5	42.3	

DISCUSSION OF THE RESULTS

The results of the tests may now be grouped under two main heads, using the average as a basis for the grouping.

In one group will be included those tests in which the two groups of subjects are about equal in ability; in the other group, the tests in which the two groups of subjects are not equal in ability.

A. Tests in which the groups were about equal in ability:

	Normal		Abnormal	
Direction Test	17±4.6		17±4.7	
Mechanical Puzzle	failure		failure	
Ball and Field Test	1 successful		3 successful	
Number Checking Test	11±7.1		12±5.1	
Tapping Test	R.	L.	R.	L.
	480	411	473	450

B. Test in which the groups were not equal in ability, the normal group being superior to the abnormal group:

	Normal	Abnormal
Opposite	36.5± 6.9	11.7± 7.7
Memory for Forms	+27.6± 1.1	−2.3± 2.0
Letter Square Method	59.2±18.5	48.7±11.7
Cancellation	38.6± 9.1	26.5± 8.1
Thurstone's Hand Test	29.3± 6.0	25.9± 2.4

The following percentages of the abnormal group in the tests indicated reached or exceeded the median achievement of the normal group:

Tapping—R. H.	41%	reached or exceeded the median
Tapping—L. H.	47%	" " " " "
Hand Test	35%	" " " " "
Memory for forms	12%	" " " " "
Direction Test	10%	" " " " "
Opposite	5%	" " " " "
Number Checking Test	41%	" " " " "
Memory square test	20%	" " " " "
Cancellation	53%	" " " " "

Although the difference in the hand-test is apparently small, the real difference in the performance of the two groups is probably much greater, as the factor of guessing cannot well be eliminated from the test and most of the guessing was done by the abnormal group. As previously stated, it is possible to make a score of 26 by mere guessing.

It seems possible to make a slightly different classification from the one just given as the tests do not seem to be of the same general class. The following classification seems to be more inclusive:

Tests of mental ability:
  Memory for forms,
  Letter square method,
  Opposites,
  Direction test.

Tests of maturity:
  Tapping test,
  Number checking test,
  Cancellation,
  Ball and field test.
Ambiguous tests:
  Mechanical puzzle,
  Hand test.

The tests listed under tests of mental ability seem to indicate a real difference in the two groups. While these cannot be termed school tests, they seem to measure ability which underlies much of our formal school work.

At nine years of age the child's finer muscular power is not nearly so well developed as at twelve years of age, so he cannot be expected to tap as rapidly as the 12 year old child. Some of this same type of ability is necessary to get on well in cancellation tests. This would be a difference between the mental age and the physiological age.

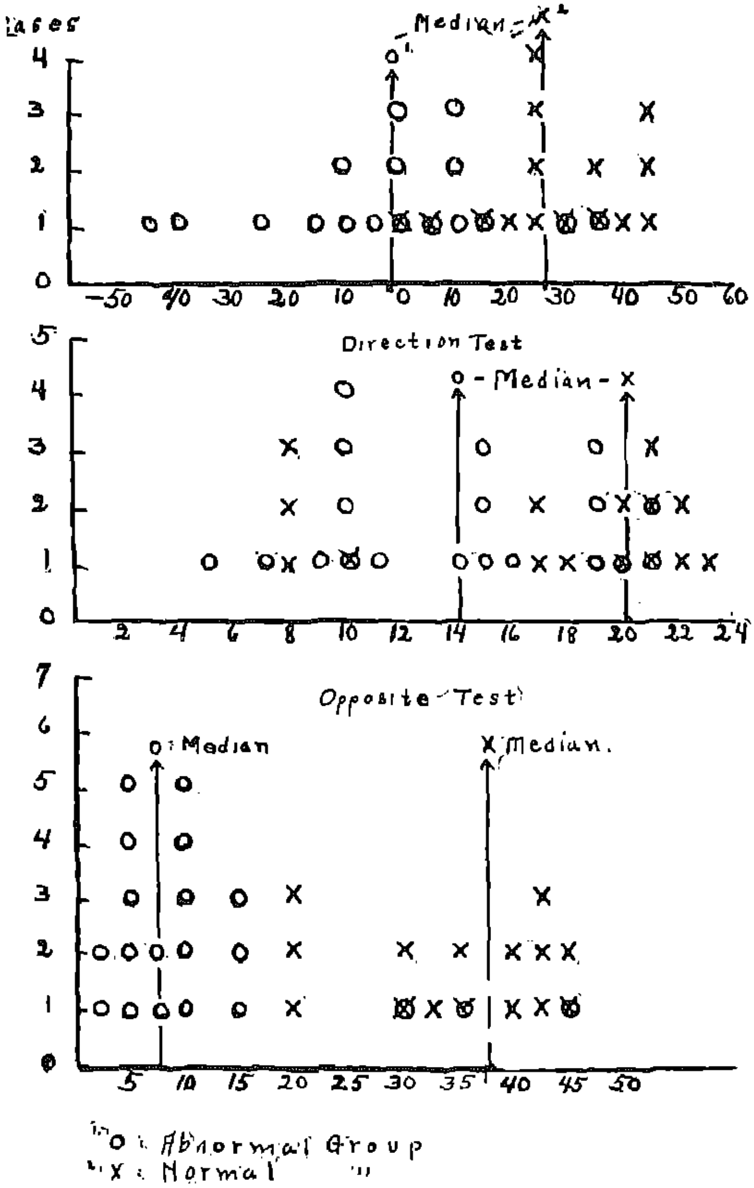
Ability to solve the ball and field test infers that the child is able to understand simple directions, then to conceive or *imagine a situation, and then in a mental way solve this* situation.

In attempting to standardize the number checking test the authors have found a rather regular progression in achievement with increase in age. Second grade children have a median of 9, sixth grade pupils 19, and adults 26.

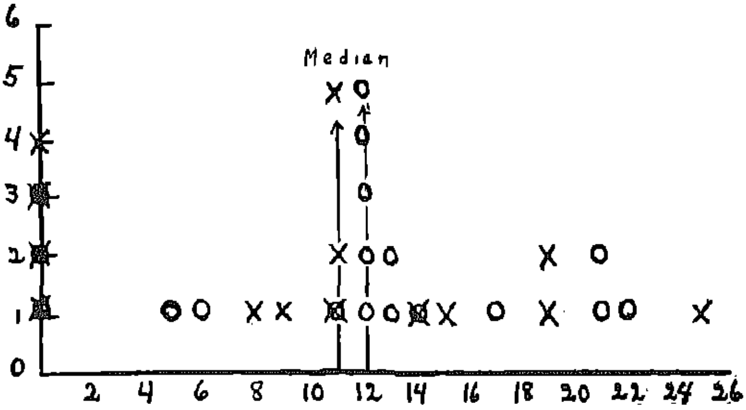
The two groups showed about equal ability in the number checking and the direction tests. Granted that the two groups had an elementary knowledge of reading, which was the case, similar results would be expected, because the older or abnormal group would balance in maturity or experience what the younger or normal group possessed in training.

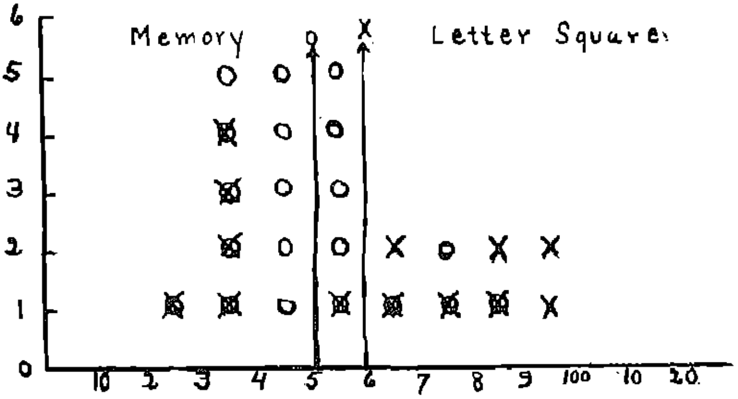
In conclusion, there seems sufficient reason for stating that the two groups are not equal in mental ability as the mental tests would indicate. In the type of ability tested by the opposite test, memory tests, and the hand test, the difference in the two groups is the greatest. This type of ability indicated by these tests is probably the kind which is most necessary to get on in the formal work of our schools as conducted at present. If, then, the results of our mental tests (Yerkes-Bridges) are to be sufficient for the classification of pupils for school purposes, they must be made more comprehensive than at present, so as to include more tests which measure school ability, or else, the tests must be so refined that they test to a greater degree than at present the general innate ability of the child.

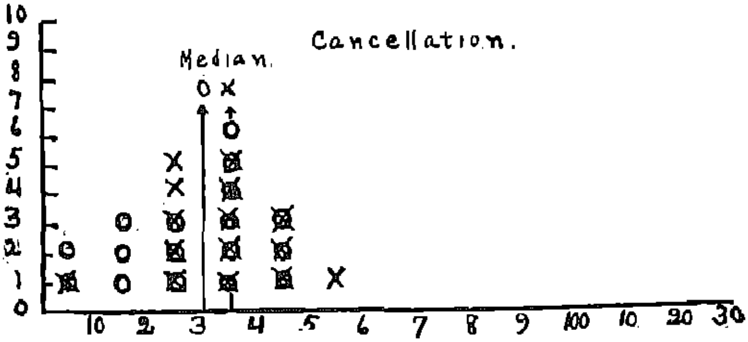
Memory for Forms



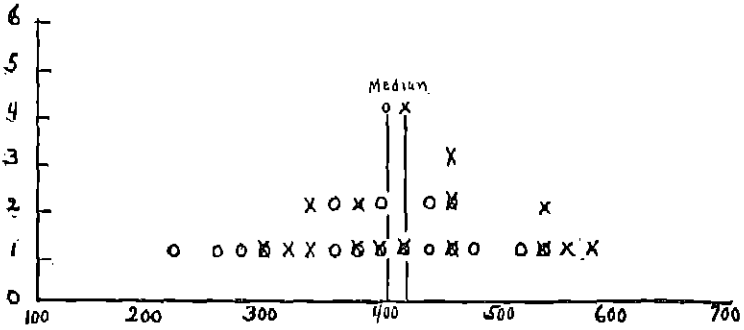
Number Checking







TAPPING — RIGHT HAND



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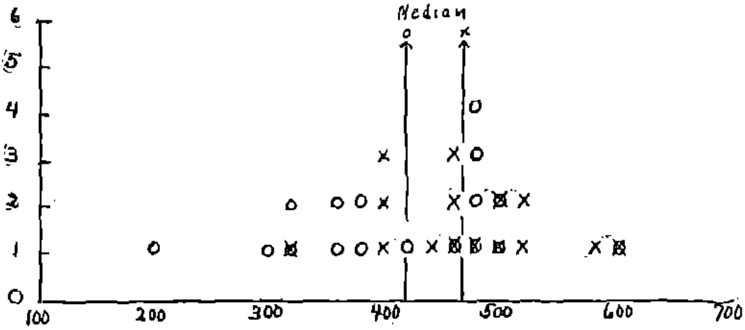
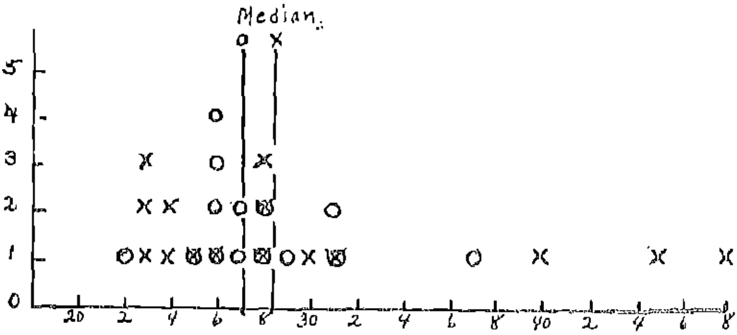


THURSTONE'S HAND TEST



SEX DIFFERENCES SHOWN BY 2,544 SCHOOL CHILDREN ON A GROUP SCALE OF INTELLIGENCE, WITH SPECIAL REFERENCE TO VARIABILITY[1]

STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF INDIANA UNIVERSITY.

By LUELLA WINIFRED PRESSEY

I. *The Problem*

At the present moment, when women are taking over to an ever increasing extent the work formerly done by men, the question as to sex differences in mental abilities is of especial interest. The problem has always, of course, been of much importance educationally, and of much general interest. Under these circumstances, the comparatively small number of adequate experimental studies of the subject is somewhat surprising. The general trend of the experimental results may, for the purposes of the present paper, be briefly indicated[2]. The general problem of sex differences in mentality has been found to involve two distinct questions, (1) Do women as a class average differently from men, either in general intelligence or in certain special traits? (2) Do women vary less about their average than men? As regards the first question, it may be said that no differences of importance have been found in general intelligence. Terman[3] with his thousand I. Q.'s found a slight but negligible superiority for the girls for the ages over which his results are reliable. Yerkes, Bridges and Hardwick[4] found no very definite or consistent sex differences. When we come to the question of differences in special abilities we find the experimental results very inconclusive and often contradictory. In general, the experimental and statistical studies lead to the conclusion that the average man has more mechanical ability, better motor control, does better on tests of judgment; in school and college he makes a relatively better showing in economics and history and the sciences, and perhaps in mathematics. Women test as averaging better in receptivity or impressibility and in sensory discrimination; they are quicker in association, have better memories; and they excel in such subjects as music and literature.

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[1] The writer wishes to acknowledge her obligation to Prof. W. F. Book for many valuable suggestions in the writing of this paper.

[2] For an excellent summary of the literature to 1914 the reader is referred to Mrs. H. B. Woolley's report in the *Psychological Bulletin* 11:353-79, 1914. Mrs. L. S. Hollingworth, in chapter X, of Professor Hollingworth's *Vocational Psychology* (Appletons, 1917), gives a brief digest of the work through 1916, also in *Psychological Bulletin* 13; 377-84, 1916.

[3] Terman, Lewis M. *The Measurement of Intelligence.* Houghton Mifflin Co., 1916, pp. 68-72.

[4] Yerkes, R. M., Bridges, and Hardwick, Rose. *A Point Scale for Measuring Mental Ability.* Warwick and York, 1914, pp. 68-73.

"The most important characteristic of these differences," says Thorndike, "is their small amount[5]." According to Thorndike, the average woman does not differ from the average man to any important degree in mental abilities. But there are more exceptional men—more male idiots (to take extreme examples) and more male geniuses. And the important feature of the test data on the subject is the greater variability shown by the men, in all the more important studies. So Thorndike gives figures showing that, in one group of tests, the variability of the women was 92% that of the men. With Thorndike's conclusions Mrs. Hollingworth takes issue Much of the data available to Thorndike in 1914 was from small, not clearly unselected groups of cases. Mrs. Hollingworth cites more adequate studies made since 1914, as by Trabue with 1,300 school children, Courtis with several thousand New York School children, the data of Terman and Pyle: "The evidence from these extensive experiments is, in all cases, that there is no sex difference in mental variability[6]." And again, "There has never been an experimental study made in which the sampling from both sexes has been large, random, equal, and from groups of equal homogeneity socially and racially, that showed any reliable sex differences in variability." (p. 233)

As regards differences in variability there is thus a sharp division of opinion among the authorities. The results are also frequently contradictory so far as differences in central tendency are concerned. The unsatisfactoriness of former experimental results regarding sex differences may be attributed for the most part, to three general causes. (1) Much of the material has been obtained from altogether too few cases, (studies have been published dealing with only nine individuals of each sex). (2) There has frequently been a question as to whether, in the groups studied, the individuals of one sex were selected on the same basis as those of the other. It is quite possible, for instance, that women university students are, on the whole, more highly selected than university men. (3) The point has also been made that the sex of the examiner might very well modify the results; men may work differently for a woman than for another man. To these criticisms, the writer would add a fourth, having to do with the interpretations of the findings; too little reference has been made in the previous studies to the possible influence of different rates of growth and development in the two sexes. Girls are from one to two years ahead in their physical growth —a fact which should surely be considered when comparing the sexes, during childhood and adolescence, in mental ability.

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[5] Thorndike, E. L. *Educational Psychology*, Vol. III, 1914, pp. 169–205.

[6] Hollingworth, H. L. *Vocational Psychology*, p. 232.

The materials of the present study, though not secured for such a purpose, seem remarkably well suited for a study of sex differences. They were obtained in a mental survey of the school population of three small Indiana cities, made in the spring of 1918, using a group scale of intelligence recently developed at Indiana University. In these three cities a total of nearly three thousand children were examined. The study is, therefore, based on a sufficient number of cases. The survey began with the third grade and in two of the cities went through the high school (in the third city, through the first year of high school); *all* the children within these limits were given the examination. The cases are, therefore, unselected. The examining was done by the writer and her husband and was about evenly divided between these two examiners; therefore any possible variations due to the sex of the examiner may be considered equalized and negligible.

The paper is then a brief report of sex differences found in the examination of school children 8-16 years old. Its purpose is twofold: (1) To discover any sex differences in central tendency in either general intelligence or special abilities, and (2) to discover any sex differences in variability in either general intelligence or special abilities.

II. *Materials and Method*

1. For determining differences in general intelligence. The three cities surveyed are about equal in size, each having a population of approximately 12,000. They are largely similar in make-up of population; the stock is almost all American with practically no foreign element[7]. All three places are old,

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[7] In two cities there are groups of colored people for whom special schools are provided. The results from these two schools have not been included in the present study.

as places in Indiana go, with a fairly stable population. The cities are thus similar enough to make it seem permissible to pool results for the purpose of analysis by sex. In City A there were 919 children examined between the ages of eight and sixteen; in City B, 693; and in City C, 932; giving a total of 2,544, of which 1,342 were girls and 1,202 were boys.

The group scale used in these surveys may be briefly described.[8] It consists of ten tests, each of twenty items, giving a total of 200 items, or "points." The examination takes about fifty minutes to give. The record blank consists of a single four page sheet. The examinations can be scored and totaled in three minutes by a stenographer. The scale is thus, in its compactness, excellently suited for survey work with large numbers of school children. The ten tests are in order as follows: (1) Rote memory (for words), (2) Logical Selection (the children are given such lists as "CHAIR—legs, arms, rockers, cushion, seat," and are told to underline the two things a chair is *never* without); (3) Practical Arithmetic; (4) Opposites; (5) Logical Memory; (6) Word Completion (the children are asked to put in the missing letters in such words as "b-n-na"); (7) Moral Classification (the children are told to put a number "1" under words meaning something you mustn't do in school, a number "2" under words that mean being good to other people, a number "3" under words meaning things that are bad for yourself, a "4" under words meaning to get things from others in ways you should not, in a list containing such words as whispering, charity, smoking, gambling); (8) Dissected Sentences; (9) Practical Information; (10) Analogies.[9]

2. For determining differences in special abilities. 880

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[8] A full description, giving facsimile record blank, directions and first norms may be found in Pressey, S. L. and L. W., A Group Scale of Intelligence, with first Norms from 1100 School Children. *J. of Appl. Psychol.*, Sept. 1918, or in the *Proceedings of the Conference on Mental Measurements*, Indiana University, 1918.

[9] The reliability of the scale used may be shown in three ways, (1) Results by age from cities A, B, and C show almost identical medians for all ages, (2) 200 cases at Ft. Wayne School for Feebleminded Youth, make scores which fall in the lowest 10% for their age while a group of brilliant children (I. Q. on Stanford Binet from 1.25 to 1.62) make scores which average at the 99th percentile for their ages in the total age distribution of cities A, B and C; (3) of the Binets given to the so-called duller pupils, those with an I. Q. of .75 or below make scores in the lowest 10% for their ages on the Group Scale. Those with an I. Q. of 1.15 or above make scores in the highest 10 percentile for their age. The scale, therefore, seems fairly reliable for grouping children according to mental ability.

cases[10] from city A have been further analyzed by test to determine also any sex differences in special abilities.

III. *Results*

1. Differences in General Intelligence. In obtaining a rating of "general intelligence" the results of the ten tests have been combined, by simply adding the number of correct items on each of the ten tests, giving the number of items correct of the total 200 items of the examination. The distribution of these total scores, by age, is given in Table I.

The first point to note is the difference in the number of cases at eight, nine, fourteen, fifteen and sixteen years. For the two younger years this difference is due to the fact that boys are more frequently retarded than girls and, since the examination did not go below the third grade, more boys of these two ages were missed than girls of the same age. After fourteen, the boys drop out more to go to work, so the numbers at the upper ages become unequal. For the ages 10-14 the groups would appear thoroughly comparable.

As will be seen, the central tendency of the girls is, at every age, slightly higher than that of the boys. This superiority in favor of the girls averages 5.6 "points." As can be seen from the table below, the slight superiority of the girls remains fairly constant until 16 when the boys' median becomes nearly equal to theirs.

The percentage of boys above the girls' median is given in Table II below.

TABLE II

Age	8	9	10	11	12	13	14	15	16
Per cent of boys above median for girls	40	34	42	41	44	39	43	41	49

This presentation by percentages is, of course, more reliable than that by points, although the major features stand out as about the same. For the ages from ten through fourteen, where the number of cases is almost the same, the percentages are very constant, averaging 42.2 with a mean variation of only 1.5.

As may be seen from Table I, the differences in variability are more marked than those in central tendency. The range has first been figured as the distance from the twenty-five to

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[10] The eight year olds have been dropped in the analysis by test because of the unequal numbers of the two sexes, due to the greater retardation among the boys. That is, a greater number of eight-year-old boys than girls were in the first and second grades, which were not tested.

TABLE I

Age	8		9		10		11	
	G	B	G	B	G	B	G	B
Score								
195								
190								
185								
180								
175								
170								
165								
160							1	1
155								1
150							2	4
145					1	1	7	9
140						2	6	6
135				1	4	6	6	6
130	1			2	5	5	7	11
125			4	2	3	6	11	9
120		1	1	4	10	3	10	8
115			3	4	11	8	22	14
110	1		11	2	13	5	13	5
105		1	2	6	5	9	13	12
100	2	1	9	5	15	9	13	11
95	3	1	8	4	14	15	11	4
90	5	3	14	8	17	12	10	8
85	6	2	11	8	11	11	4	12
80	5	6	17	11	7	5	5	7
75	9	3	10	6	13	7	4	7
70	14	5	7	14	10	9	5	8
65	13	6	11	7	10	9	4	8
60	9	3	9	8	7	12	1	8
55	6	4	10	8	6	8	4	4
50	5	5	7	11	3	9	2	3
45	7	3	9	7	1	5		1
40	1	3	5	2	5	7	4	4
35	1	4	3	3	2	5		2
30	1		1	2	3	4	2	1
25	2	1	1	4	1	1		2
20		3	1	2		1	1	1
15		1		1		1	1	1
10	1	1						
5						1		1
No.	92	57	154	132	177	176	167	179
Med.	70.0	65.5	80.9	73.9	92.9	86.8	109.8	103.4
25%	59.0	47.0	60.8	55.6	73.2	60.8	92.3	75.5
75%	80.0	80.7	95.0	93.1	111.1	105.6	124.2	126.3
10%	47.3	28.5	47.4	43.0	57.3	43.3	67.1	57.3
90%	92.8	93.9	111.7	114.5	122.6	127.0	139.5	142.6

TABLE I—Continued

12		13		14		15		16		
G	B	G	B	G	B	G	B	G	B	Score
										195
										190
										185
			1			2	2			180
			3		1	5	1	4	1	175
	1	2	1	3	2	5	2	3	2	170
1	1	6	1	4	5	8	6	6	9	165
6	3	5	6	12	11	9	5	10	4	160
3	5	7	7	11	9	16	14	14	7	155
2	4	11	10	20	2	12	7	9	5	150
7	9	19	8	11	12	11	5	7	4	145
11	7	15	8	12	13	15	5	10	11	140
11	11	12	11	22	11	12	9	11	5	135
9	12	15	16	9	15	20	11	5	4	130
13	13	12	21	18	3	6	3	5	3	125
18	12	14	10	8	9	6	2	4		120
24	8	15	13	12	2	1	8	2	4	115
13	10	7	5	6	12	4	8	2	1	110
7	13	12	11	6	4	2	2	1	1	105
15	16	3	7	2	3	3	4	2		100
12	12	2	5		3	1		2		95
8	12	7	8	2	3		3			90
2	3	1	3	1	3		2			85
5	3	3	2		3		2			80
2	6	1	1		1					75
2	3	1	4		3	1				70
2	2	1	2	1	1					65
1	3		2	1	1					60
	1	2								55
1	3		3						1	50
2	2		2	1			1			45
	3	1	2	1	2					40
	4		1		1					35
					1					30
2					1					25
					1					20
1										15
										10
										5
180	182	174	174	162	138	139	102	97	62	
118.1	112.6	131.5	125.9	138.2	134.0	144.5	138.3	148.2	146.9	
101.6	95.2	115.8	105.2	125.2	111.4	132.7	117.5	135.5	136.2	
132.8	133.2	146.7	141.0	152.3	148.4	158.2	156.5	159.3	160.0	
85.0	70.3	96.0	81.0	111.8	81.6	121.5	103.0	120.8	118.6	
145.8	146.7	156.9	156.2	161.1	162.4	168.9	165.5	167.8	168.4	

TABLE I

Age	8		9		10		11	
	G	B	G	B	G	B	G	B
Score								
195								
190								
185								
180								
175								
170								
165								
160							1	1
155								1
150							2	4
145					1	1	7	9
140						2	6	6
135				1	4	6	6	6
130	1			2	5	5	7	11
125			4	2	3	6	11	9
120		1	1	4	10	3	10	8
115			3	4	11	8	22	14
110	1		11	2	13	5	13	5
105		1	2	6	5	9	13	12
100	2	1	9	5	15	9	13	11
95	3	1	8	4	14	15	11	4
90	5	3	14	8	17	12	10	8
85	6	2	11	8	11	11	4	12
80	5	6	17	11	7	5	5	7
75	9	3	10	6	13	7	4	7
70	14	5	7	14	10	9	5	8
65	13	6	11	7	10	9	4	8
60	9	3	9	8	7	12	1	8
55	6	4	10	8	6	8	4	4
50	5	5	7	11	3	9	2	3
45	7	3	9	7	1	5		1
40	1	3	5	2	5	7	4	4
35	1	4	3	3	2	5		2
30	1		1	2	3	4	2	1
25	2	1	1	4	1	1		2
20		3	1	2		1	1	1
15		1		1		1	1	1
10	1	1						
5						1		1
No.	92	57	154	132	177	176	167	179
Med.	70.0	65.5	80.9	73.9	92.9	86.8	109.8	103.4
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75%	80.0	80.7	95.0	93.1	111.1	105.6	124.2	126.3
10%	47.3	28.5	47.4	43.0	57.3	43.3	67.1	57.3
90%	92.8	93.9	111.7	114.5	122.6	127.0	139.5	142.6

TABLE I—Continued

12		13		14		15		16		
G	B	G	B	G	B	G	B	G	B	Score
										195
										190
										185
			1			2	2			180
			3		1	5	1	4	1	175
	1	2	1	3	2	5	2	3	2	170
1	1	6	1	4	5	8	6	6	9	165
6	3	5	6	12	11	9	5	10	4	160
3	5	7	7	11	9	16	14	14	7	155
2	4	11	10	20	2	12	7	9	5	150
7	9	19	8	11	12	11	5	7	4	145
11	7	15	8	12	13	15	5	10	11	140
11	11	12	11	22	11	12	9	11	5	135
9	12	15	16	9	15	20	11	5	4	130
13	13	12	21	18	3	6	3	5	3	125
18	12	14	10	8	9	6	2	4		120
24	8	15	13	12	2	1	8	2	4	115
13	10	7	5	6	12	4	8	2	1	110
7	13	12	11	6	4	2	2	1	1	105
15	16	3	7	2	3	3	4	2		100
12	12	2	5		3	1		2		95
8	12	7	8	2	3		3			90
2	3	1	3	1	3		2			85
5	3	3	2		3		2			80
2	6	1	1		1					75
2	3	1	4		3	1				70
2	2	1	2	1	1					65
1	3		2	1	1					60
	1	2								55
1	3		3						1	50
2	2		2	1			1			45
	3	1	2	1	2					40
	4		1		1					35
					1					30
2					1					25
					1					20
1										15
										10
										5
180	182	174	174	162	138	139	102	97	62	
118.1	112.6	131.5	125.9	138.2	134.0	144.5	138.3	148.2	146.9	
101.6	95.2	115.8	105.2	125.2	111.4	132.7	117.5	135.5	136.2	
132.8	133.2	146.7	141.0	152.3	148.4	158.2	156.5	159.3	160.0	
85.0	70.3	96.0	81.0	111.8	81.6	121.5	103.0	120.8	118.6	
145.8	146.7	156.9	156.2	161.1	162.4	168.9	165.5	167.8	168.4	

the seventy-five percentiles. The per cent which the girls' range is of the boys,' at each age, is shown in the table III.

Table III

Age	8	9	10	11	12	13	14	15	16
Per cent	62	93	84	64	84	86	72	66	1.01

The boys' range, figured in this way is, at every age except sixteen, greater than that of the girls.

The above method of presenting variability seems inadequate. It merely states that the boys vary more around their own median than the girls do around theirs. It does not offer any contribution to the question as to whether boys are more often extremely brilliant or extremely dull. The boys might vary more around their own median and still not show a single case which had as high a score as the most brilliant of the girls. The writer has therefore made use of another method of stating the results. The percentage of boys above the girls' seventy-five percentile and below the girls' twenty-five percentile has been found; if the boys show more cases of extreme brilliancy or extreme dullness, they will have more than twenty-five per cent of their cases outside the girls' percentiles. The two tables are given below.

Table IV

Age	8	9	10	11	12	13	14	15	16	Av
Per cent of boys below girls' 25%	44	31	38	42	34	34	39	40	22	35
Per cent of boys above girls' 75%	26	23	20	27	25	20	21	20	27	23

The percentages average 35% of boys below the girls' twenty-five percentile and 23% above the girls' seventy-five percentile.

The ten and ninety percentiles were also reckoned. It seemed of especial interest to know what the distribution was at the very extremes, where the exceedingly dull and exceedingly brilliant children should be found. The number of cases at each age is large enough to make the percentiles reliable. The ten and ninety percentiles given below average 20.6% of the boys below the girls' ten percentile and 10.4% of the boys above the girls' ninety percentile.

Table V

Age	8	9	10	11	12	13	14	15	16	Av.
Per cent of boys below girls' 10%	25	20	21	18	16	18	26	29	13	20.6
Per cent of boys above girls' 90%	11	9	12	12	11	10	12	6	11	10.4

One other method of estimating sex differences at the extremes was tried. The number of boys and girls, at each age, in the highest and lowest ten percentiles[11] was found. The highest ten per cent for all ages, and both sexes combined, is composed of 50 per cent boys and 50 per cent girls—134 of one sex and 133 of the other. Of the lowest ten per cent, 61% (165 cases) are boys, leaving only 39% (102 cases) girls. This added data seemed fairly conclusive, but the writer wished to examine the very extremes—the upper and lower three per cent (the limits within which feeble-mindedness or supernormality may be expected)—and, if possible, the highest and lowest one per cent. Such results would be strictly reliable for only four ages—from 10 through 13—as these were the only ages not affected by the school selection referred to above. Four ages yield only a small amount of data in number of cases at these extremes. But this data seems reliable, as there are 1,471 cases at these ages (there are not less than 362 cases at any age) and none of the cases are in any way selected. The results are as follows: the upper three percentile is made up of 66% (27 cases) boys and 34% (14 cases) girls. The lowest three per cent also includes 66% boys (27 cases) and 34% girls (14 cases). The highest one per cent for all four ages is composed of 86% boys (12 cases) and 14% girls (2 cases), while the lowest one per cent has 64% boys (9 cases) and 36% girls (5 cases). These figures are, of course, inadequate for any absolute conclusion, but they surely suggest that the farther into either extreme investigation is carried the more the boys seem to predominate. This is all the more surprising as the boys' median is for every age lower than the girls' median.

The results from the analysis of the total scores may be briefly summarized as follows: (1) the girls have at every age, a slightly higher median than the boys, (2) the boys show a greater variation around their median than do the girls, (3) the boys show more dull cases at every age than do the girls and a few more bright ones. The number of boys and girls in the highest ten per cent for all ages combined is exactly the same. On four reliable ages, both the upper and the lower three per cents are composed mainly of boys; the highest and lowest one per cents are composed almost wholly of boys.

2. Differences in Special Abilities. The tests have already been briefly described. For the purpose of comparing the

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[11] The percentiles used were derived from a table giving the scores for 2,676 children (ages 8-16) in cities A, B and C combined. There were 128 children whose sex could not be determined from the papers. These children are not included in Table I.

sexes as to special abilities they may be classified into five general types. There are two tests of memory, one rote memory for words, and the other logical memory for a passage read. There is one test of judgment (Logical Selection) in which the child is asked to discriminate between the essential and the non-essential. There are five tests that might be described as "literary tests:" these are Opposites, Word Completion, Classification of Moral terms, Analogies and Dissected Sentences. One test calls for practical information in ten different fields. Another test is one of arithmetical reasoning, in which problems, of a kind that school training would help very little in solving, are given. The analysis by test brings out the differences in sex for the mental functions tested.

Again there are fewer boys than girls at nine, fifteen and sixteen, for the reasons stated above; the results for ages 10-14 would seem thoroughly reliable.

TABLE VI

Age	9	10	11	12	13	14	15	16	Total
No. of girls	49	41	56	60	59	68	60	56	441
No. of boys	41	51	65	67	63	65	47	32	439

The central tendency on each test at each age was first determined. Table VII shows the per cent of boys who make a score above the girls' median. There is little of importance in the variations from year to year except that, at sixteen, the boys show superiority on all but the 4th test. Tests six and eight (word completion and dissected sentences) are for all ages in favor of the girls up to sixteen. Tests one, four, seven and ten also show superiority for the girls. Test three (arithmetic) is entirely in favor of the boys at all ages as is test nine (practical information) from eleven years on. On

TABLE VII

Results by test: Per cent of Boys making a Score above the Girls' Median for their Age

Tests:	1	2	3	4	5	6	7	8	9	10
Age										
9	35	49	70	49	50	33	37	49	36	33
10	51	45	60	32	44	29	24	32	36	42
11	43	49	55	50	51	50	50	32	45	40
12	45	48	68	53	62	40	37	35	65	55
13	46	56	61	41	44	41	39	47	52	50
14	47	32	63	34	43	43	29	46	60	37
15	38	58	52	45	31	43	52	41	53	42
16	52	50	74	45	57	54	62	52	63	59
Av.	45	48	63	44	48	42	41	42	51	45

the second test, one of judgment, and the fifth (logical memory) the girls have only a very slightly higher median than the boys. The girls are then, ahead on rote memory, and on the literary tests (opposites, word completion, classification of moral terms, dissected sentences and analogies); they are slightly ahead on the test of judgment and a test of logical memory; the boys show a superior ability on the arithmetic test and a slightly higher average on the test for practical information.

Table VIII

Results by test: Per cent which the Girls' Range (25-75 *Percentile*) *is of the Boys' Range*

Tests:	1	2	3	4	5	6	7	8	9	10
Age										
9	1.35	64	70	82	84	98	79	1.53	65	99
10	87	87	81	80	1.00	97	66	98	51	81
11	78	72	1.00	44	1.08	84	76	56	68	79
12	70	69	1.10	76	95	1.02	96	87	84	1.10
13	87	1.02	95	74	88	84	69	97	94	74
14	66	87	91	78	1.58	49	71	75	61	84
15	1.10	74	1.31	72	71	87	83	71	1.03	1.41
16	69	93	94	1.09	1.04	79	92	1.00	1.07	1.78
Av.	88	81	96	77	1.01	85	79	92	80	1.06

Table IX

Results by test: Per cent of Boys making Scores below the Girls' 25 *Percentile for their Age*

Tests:	1	2	3	4	5	6	7	8	9	10
Age										
9	29	33	21	37	27	41	39	20	32	34
10	29	27	16	31	29	43	51	47	45	39
11	34	29	20	40	18	32	34	40	35	29
12	36	37	07	33	22	33	39	36	26	20
13	33	21	16	37	25	38	40	40	25	30
14	40	46	21	41	14	40	48	40	28	32
15	36	23	17	38	40	28	32	40	23	21
16	31	27	06	22	09	28	22	28	19	14
Av.	33	32	15	35	23	35	38	36	29	27

But the range, or variability, is again of more interest than the medians. This range has been worked out in the same three ways as the range for the total score: (1) the per cent which the girls' range is of the boys; (2) the per cent of boys making scores above and below the girls' seventy-five and twenty-five percentiles, and (3) the per cent of boys making scores above and below the girls' ten and ninety percentiles.

Table VIII gives the per cent which the girls' range is of the boys', and shows that at most ages, for all tests, the boys have

TABLE X

Results by test: Per cent of Boys making a Score above the Girls' 75 Percentile for their Age

Tests:	1	2	3	4	5	6	7	8	9	10
Age										
9	10	27	44	22	29	20	20	20	29	22
10	22	25	33	26	20	12	18	08	22	23
11	28	28	28	32	29	18	17	31	25	25
12	22	28	39	28	32	09	20	18	34	24
13	25	27	33	19	38	18	29	18	30	29
14	28	17	34	20	11	32	23	26	38	15
15	09	42	21	23	23	19	23	30	26	19
16	31	35	47	25	44	31	37	22	41	16
Av.	22	29	34	24	27	20	23	21	31	21

a greater range than the girls. The occasional large variation, particularly at certain ages where the cases are unequal, upsets the averages. The table is better summarized by the statement that out of the *eighty* range distributions presented, only *sixteen* show a greater range for the girls. The amount of range for both sexes varies considerably, but the prominent feature of the table stands out,—namely that the boys show a greater range about their median score than do the girls.

Table IX shows the per cent of boys making a score below the girls' twenty-five percentile. The per cent is generally more than twenty-five,—except for the third test, on which it is always less. That is, the boys show more low scores than do the girls. The fifth and tenth tests are somewhat irregular and do not show as definite a tendency as the others. All other tests except the third, show a range for the boys which extends considerably below that of the girls. The third test is unique; the worst boys are better than the worst girls, and the boys clearly predominate at the upper end of the distribution (see Table X). A similar extension of the boys'

TABLE XI

Per cent of Boys who Score below the Girls' 10 *Percentile for their Age*

Tests:	1	2	3	4	5	6	7	8	9	10
Age										
9	17	27	10	07	15	17	10	12	15	19
10	18	06	04	16	16	21	20	20	29	22
11	15	18	09	22	09	22	19	16	17	17
12	27	21	03	11	07	16	19	25	13	12
13	14	13	03	14	13	22	14	11	13	19
14	12	23	09	25	00	25	18	20	15	26
15	28	13	00	15	26	18	23	19	17	17
16	20	06	03	09	06	06	12	16	16	03
Av.	19	16	05	13	15	18	17	14	17	17

distribution beyond the best of the girls' appears on test nine, Practical Information. The first, sixth, seventh, eighth and tenth tests show for the most part less than 25% above the 75 percentile; on the remaining tests there is no definite tendency in either direction.

TABLE XII

Per cent of Boys who Score above the Girls' 90 Percentile for their Age

Tests:	1	2	3	4	5	6	7	8	9	10
Age										
9	07	14	19	10	15	07	10	12	19	07
10	08	14	25	20	08	02	10	08	10	10
11	12	14	15	08	06	05	06	11	11	11
12	10	10	19	09	16	01	04	07	12	12
13	14	17	17	06	10	06	15	10	14	14
14	12	11	22	11	04	13	15	11	22	09
15	02	19	11	09	09	06	13	09	09	04
16	08	15	28	09	18	13	19	12	28	04
Av.	09	14	19	10	11	04	11	10	14	09

Similar tables for the ten and ninety percentiles, (Tables XI and XII) giving the per cent of boys above and below these percentiles for the girls, show much the same relations. They are included to show the distributions at the extremes as well as at the quartiles; it should be noticed that according to these tables, the boys show a greater variability on *all* the tests.

The figures for the 10 and 90 percentiles (Tables XI and XII) have been averaged and represented graphically in Chart I. The vertical black lines indicate the ranges for the girls on each of the ten tests; the shaded lines indicate the distributions of the boys, expressed in percentages of the girls' distributions. The horizontal lines, running entirely across the page, mark the various percentile divisions for the girls' distribution. The short cross-lines, intersecting the shaded vertical lines, represent the medians for the boys. For example, on the last test only 45% of the boys make scores above the girls' median score (see Table VII); the boys' median has therefore, been drawn at the girls' forty-five percentile (a on Chart I). And since on this same test(Test 10)there are 19% of the boys below the girls' ten percentile, the lower end of the boys' distribution line is extended 9% below the girls distribution line (b on Chart I); since there are 9% of the boys who score above the girls' ninety percentile, the upper end of the boys' distribution line has been extended only to the girls' 99 percentile (c on Chart I). The various relationships between the total distributions of the sexes is therefore roughly pictured. On the third test, the boys' median is at the girls' 63 percentile (d on

CHART I

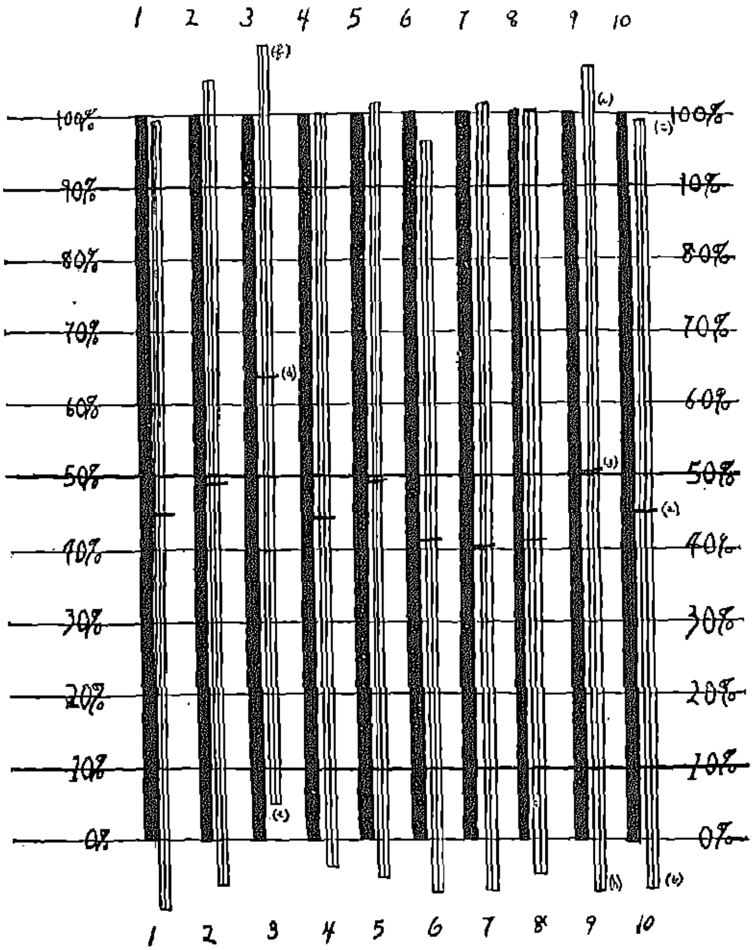

Chart I) and, as would be expected, the boys' distribution extends far above the girls' and does not reach down as far as theirs (e and f on Chart I). On the ninth test the boys' median is at the girls' 52nd percentile (g on Chart I) and the boys' distribution extends evenly above and below that of the girls' (h and i on Chart I). The influence of the position of the medians on the relation between the distributions is thus brought out. The sixth test also shows a greater range for the boys, but even the exceptional boy does not do as well as the exceptional girl on this test. A mere statement of range is obviously inadequate as an accurate description of the situation.

IV. *Discussion*

A. Differences in Central Tendency. The results in total score show the boys to average throughout lower than the girls; in terms of mental age (taking the average increase in score from year to year to represent one year in mental growth) the boys test about six months below the girls. Three possible explanations of the higher averages of the girls occur to the writer: (1) It would seem reasonable to connect the fact of their higher score with the well known fact of the more rapid physical development of girls. The lower averages of the boys would then be evidence of an analogous slower mental development. The writer is surprised that such an explanation has not been more stressed in previous work where the mental abilities of young people have been compared. It is quite in keeping with other facts, such as the greater school retardation of boys, and helps in our understanding of such facts. The writer believes the lower averages of the boys to be due primarily to this factor of slower mental growth.

Perhaps the reason that such an explanation has not been more emphasized is to be found in the fact that test measurements with adults have for the most part shown women to average slightly higher than men. A second explanation is here suggested. (2) It is possible that women *and* girls average slightly above men and boys; that there is a slight female superiority in the average—which compensates, one might say, for the greater variability of the male. If the differences in the averages which appear in the present study should be found, upon examining representative groups of adults, to continue into maturity, it is obvious that they would not be considered the result merely of different rates of development. If, on the other hand, in the late teens the boys should be found equalling or excelling the girls, we should have good grounds for considering the higher averages of the school girls only a temporary developmental matter of much less importance. In the present study the averages for the two sexes come almost together at sixteen. But the number of cases must be noticed. There are half again as many girls as boys at this age. That is, many more boys have by this age left school. In general, it is the less able, retarded boys who drop out. At sixteen the school boys are a more highly selected group, and their relatively higher average may be merely an expression of this fact. The data of the present study thus offers little either for or against this second explanation. We must wait for measurements from large groups of unselected adults before we can settle the question. Thus far no such measurements, from groups of men and of women which could be supposed similarly selected and equally representative of the two sexes, have been obtained.

A third possible explanation of the higher total scores made by the girls must, however, be pointed out. On eight of the ten tests making up the scale the girls do better on the whole than the boys; on two tests the boys show a definite superiority. It is quite conceivable that differences in rate of development may play no part whatever in producing the above mentioned differences in total score. These differences may (3) be due to a weighting of the scale with a majority of tests which are easier for the girls. Previous experimental studies of sex differences have for the most part agreed in showing girls and women to do better than boys and men in controlled association, in readiness in handling language forms, and in memory. Seven of the tests of the scale sample just such abilities. It might be possible to build another scale, of arithmetic, practical information, spacial relation and puzzle tests, on which the boys would excel. At least it would seem reasonable to conclude, that in building a scale, or in interpreting the results of one, sex differences in reaction to different types of test should not be neglected; a glance at the median points for the arithmetic (3rd) and the moral classification (7th) tests on the graph should make this clear. Twenty-six per cent of the girls' distribution is between the boys' median on the one and the other. In other words, the differences in medians for the sexes may have been put into the scale by the selection of tests. Again future results from unselected groups of adults must be looked to, for any adequate understanding of the situation.

B. Differences in Variability. The sex differences in central tendency thus admit of various explanations. It is harder to see how the greater variability of the boys permits any other conclusion than that the boys show greater variations in mental capacity. Three possible explanations have, however, occurred to the writer: (1) The greater variability found in the results may be only a matter of development; among boys development may be more irregular. So far as the writer knows, anthropological data do not show this. (2) Or it may be that there is greater male variability in mental endowment. Again we must wait for similar mental measurements from adults, in order to settle the question as to whether men vary more in mental ability than women: such a conclusion can hardly be inferred from experimental studies of children. The writer feels, however, that the results of the present study hardly permit of any other interpretation than that age for age, boys show more extremely bright, and extremely dull, individuals than do the girls.

It should, however, be pointed out that differences in variability are different in different tests; the logical memory test shows little sex difference in variability. A third explanation is thus possible: (3) it is conceivable that comparative variability might also vary to some extent with the nature of the test.

The results presented in the body of the paper thus admit of various interpretations. But at least it would appear plainly indicated that sex differences among school children are by no means so negligible as they are usually taken to be, and that these differences are such as can be measured with fair definiteness by mental tests. If the writer's findings are correct (and the present study is, she believes, the most adequate thus far, in both material and method) there is opportunity here for extremely interesting further research. And meanwhile it would hardly seem possible to neglect, in quite the easy fashion usual hitherto, the possibility of sex differences in reaction to tests of "General Intelligence." Tests showing sex differences as marked as do the third and eighth used in the present study, in both average and variability, can hardly be combined in a single scale without at least a recognition of these differences.[12]

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[12] As a matter of fact the scale used in this study is now being reformed with these findings especially in mind. This derived scale consists of four tests. The first consists of twenty-five disarranged sentences, within each sentence one extra word (so "brown the horse come is"); the children are asked to cross out the extra word. The second consists of twenty-five lists of words, each list naming four similar objects and one object different (so "oats, wheat, barley, cotton, rye,"); the children are told to cross out the thing that is different. The third test is made up of twenty-five number series, with in each one misplaced number (so 2, 3, 6, 9, 8); the class is asked to cross out the number which is wrong. And in the last test there are twenty-five lists of moral qualities (as "laziness, idleness, tardiness, slowness, haste"), and the directions are to cross out the one which is worst. A first trial of this "cross-out" scale shows the girls to do better on the first and last tests, the boys on the second and third; the result is a total rating where the sexes average about the same age for age.

Incidentally, the tests embody a principle of test construction—what might be called the method of the "extra element"—which would seem of some general value. A substitution test, for example, with the substitutions made but in each line one made wrong (the subject to

V. *General Summary*

The paper may be briefly summarized. Results from 2,544 school children, ranging in age from 8 through 16, with a group scale of intelligence have led to the following conclusions:

1. The girls average slightly higher in total score or "general intelligence" than the boys. More rapid development on the part of the girls is suggested as the most probable explanation.

2. Analysis by test shows the comparative standing of the two sexes to vary according to the nature of the test. On three tests the boys average above the girls, on the remaining seven tests the girls excel.

3. The distribution of total scores shows a remarkably greater variability among the boys than among the girls. This would suggest either (a) a greater variability in rate of mental development among boys, or (b) a permanent greater variability in general intelligence among males.

4. Analysis by test shows in no instance a greater variability among the girls. The amount of sex difference in variability varies widely from test to test however; three tests show little difference. These facts suggest that neither in averages nor in variabilities are we dealing solely with some "general" ability, but that both average and variability differ to a considerable extent according to the nature of the function tested.

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cross out the wrong one) would be easier to handle, and perhaps more differential, than the usual form of such tests.

TWENTY-THREE SERIAL TESTS OF INTELLIGENCE AND THEIR INTERCORRELATIONS

By Lewis M. Terman and Mrs. Mary B. Chamberlain

During the school year 1915-1916 the seminar in intelligence tests at Stanford University undertook to gather preliminary material which it was hoped would serve as a point of departure in the working out of a new intelligence scale. The ultimate aim was to devise a scale which would be equally usable as a point scale and as a mental age scale.

The first task was to assemble tests which would correlate with other measures of intelligence and which would lend themselves to the principle of serial arrangement. The first half of the school year was devoted to the assembling and modification of promising tests which others had used and to the devising of new ones. The result was a group of twenty-three serial tests, each including from five to fifty items. The next step was to try out these tests on a number of school children who had been Bineted and regarding whose school success complete data were available. This was undertaken by one of the writers, (Mrs. Chamberlain). Forty-one children were tested; five in each of the eight grades, and one additional in the sixth grade by mistake.

It was the original intention to sift out the poorer tests on the basis of these results, to revise and supplement the better ones, and to proceed during the following year to the standardization of the test for a new scale for individual testing. Later it was decided to hold this in abeyance in favor of a plan for group testing. We were led to this decision chiefly by the ingenuity of Arthur S. Otis in devising suitable methods for giving and scoring group tests.

The work of Mrs. Chamberlain has not, however, been without results. In the first place it contributed directly to the selection and arrangement of tests for the Otis Scale. Later a number of items of the tests were incorporated in the psychological methods used in the army. The intercorrelations found for the tests, (see Table I) have also proved of value in a number of connections. The tests and the correlations are here presented in the hope that they may have at least some suggestive value to other workers.

It is not deemed necessary to describe in detail the procedure and the methods of scoring. The experiment was carefully planned, the tests were made under the most favorable conditions, and the procedure and scoring were rigidly uniform. The subjects were chosen by school grade. (five from each grade), and not by age or mental age. All were given the Stanford Revision of the Binet scale. Counting the Binet test, from three to four hours, and as many sittings, were required for each pupil. The attitude of the children was everything that could have been desired. The "mental ages" of the subjects by the Stanford Revision were fairly evenly distributed from 6 to 16 years. The twenty-three serial tests which were given to these forty-one children were as follows:

Test 1. Picture Naming. (Devised by Mr. Otis).

Three cards, 8½ x 11, each containing a large number of small pictures of familiar objects. The pictures were cut from a catalogue of a mail order firm and pasted on the cards. They were reasonably distinct. The subject was simply asked to name the object. The following pictures were used:

CARD I

knife, spoon, axe, screw,
feather, water tap, brush, comb,
scales, chair, wheel, shoe, man,
shirt, baby buggy, comb, umbrella, auto,
flag, pipe, collar, dog, razor, belt,
saw, monkey wrench, padlock, knife and fork, ring.

CARD II

violin, clock, stockings, gloves, table,
horn, bracelet, spy glasses, suit case, book,
bottle, hat, vessel, hammock, tennis racket, basket ball
plow, sewing machine, lantern, stove, suspenders,
fountain pen, scissors, hoe, bucket.

CARD III

camera, watch chain, hand bag, sweater, bed,
trunk, buggy, lounge, watch,
dresser, saddle, coat, flume, telephone,
pincers, paint brush, hinge, hammer,

Scoring.—One point for each object correctly named.

Test 2. Oral Reading. (Gray)

For this test the W. S. Gray oral reading scale was used, unchanged except for the omission of "Passage a" and "Passage j." The method of giving and scoring was that described by Thorndike in *The Teachers' College Record,* 1914, pp. 67-69.

Test 3. Origin of Familiar Things[1]

1. Where do eggs come from?
2. Where does butter come from?
3. What are cigars made of?
4. Where does leather come from?
5. Where does cotton come from?
6. Where does wool come from?
7. Where does cheese come from?
8. What are bricks made of?
9. Where does lard come from?
10. What are razors made of?
11. Where does silk come from?
12. Where does kerosene (or coal oil) come from?
13. Where does sugar come from?
14. How do they get salt?
15. What is glass made of?
16. What is paper made of?
17. What are dishes made of?
18. Where does rubber come from?
19. Where do oysters come from?
20. Where do corks for bottles come from?
21. Where does ivory come from?
22. Where does linen come from?
23. Where does a sponge come from?
24. Where do pearls come from?
25. Where do diamonds come from?
26. Where does camphor come from?
27. Where does quinine come from?
28. What is soap made of?
29. Where does asbestos come from?
30. How do they get brass?

Scoring.—One point for each successful answer.

Test 4. Orientation in Time. (Arranged by Terman).

1. When is it night? When is it day?
2. When is it morning? When is it afternoon?
3. What do we mean by yesterday? Tomorrow? Today?
4. When is it noon? Midnight?
5. Name the days of the week. (Check as in Stanford Revision.)
6. Name the seasons. What season comes before spring? Before autumn?
7. In what season is it hot? Cold? In what season do the leaves fall off?
8. In what season are the longest days? The shortest days?
9. What day of the week is today?
10. What month is it now?
11. What day of the month is it? (Allow error of three days.)
12. What year is it?
13. Name the months of the year (no error). (Check.)
14. Tells time (c need only be correct within one minute).
    a) Hands at 8:30. Hands at 3:00.
    b) Hands at 10:35. Hands at 2:20.
    c) Hands at 1:48. Hands at 6:23.

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[1] Arranged by Terman. The test was suggested by Dr. Stanley Hall's study of the contents of children's minds on entering school.

15. New Year's comes in what month? On what day of the month?
16. Christmas comes in what month? On what day of the month?
17. How many days in a week? In a year?
18. How many days in each month?
19. How is leap year different from other years?
20. How long is it from one new moon to the next new moon?
21. Suppose today was Tuesday, March 15th; what day of the week would it be on April 15th next?
22. Suppose today was Friday, September 20th. What day of the month would it be two weeks from today?

Scoring.—One point for each, except 14, which receives 3 points.

Test 5. Direction Orientation. (Terman)

"Suppose you are in a city where the streets run north and south, and east and west, then," etc.

1. Suppose you are going north, then you turn to your right; what direction are you going now?
2. Going west, then turn to left?
3. Going east, then turn to right?
4. Going north, then L., then R.?
5. Going west, then R., then R. again?
6. Going south, then L., then R. again?
7. North, then R., then R. again, then L.?
8. South, then L., then R., then L.?
9. West, then R., then R. again, then R. again?
10. North, then L., then L. again, then R., then R.?
11. West, then R., then R. again, then R. again, then L.?
12. South, then L., then L. again, then R., then L.?

Scoring.—One point for each.

Test 6. Mastery of Space Concepts. (Terman)

1. a Which way is up? Point your finger up.
   b Which way is down? Point your finger down.
2. a Which way is in front of you? Point in front of you.
   b Which way is behind you?
3. a Put the little block on top of the big block.
   b Put the little block under the big block.
4. a Which block is closer to you?
   (3 trials with blocks in alternate positions.)
   b Which block is farther from you?
   (3 trials with blocks in alternate positions.)
5. a Place the big block on the table between the pencil and knife.
   (Present them all in one hand.)
   b Place the pencil on one side of the knife and the block on the other side.
   (Present again in one hand.)
6. Right hand .... Left ear .... Right eye.
7. a Name the four directions .... North .... go ahead ....
   b What are the directions between the ones you named?
8. a In what direction does the sun rise?
   b In what direction does the sun set?

9. a Which way would you have to face so your left hand would be toward the east?
   b Which way would you have to face so your right hand would be north?
10. a Which way would you have to face so your left hand would be toward the north-east?
   b. Which way would you have to face so your right hand would be toward the north-west?

Scoring.—One point for each of the 20 items in the series.

Test 7. Memory for Sentences

(Arranged by Otis and Terman)

1. Kitty runs fast.
2. The man's coat is black.
3. The book is on the floor.
4. It is a very hot day.
5. The boy is playing with his blocks.
6. George had his picture taken today.
7. The cow gives nice sweet milk for me to drink.
8. The boy fell and the wagon ran over his foot.
9. The fire whistle blew and the firemen hurried down the street.
10. The mother robin flew away to get food for her little ones.
11. The men pick the ripe oranges from the trees and pack them away in boxes.
12. A fearful flood swept over the city one night and drowned nearly all the people.
13. When the rabbit runs out of the bushes the dogs will bark and the hunter will fire his gun.
14. We subscribed for a new magazine some time ago, but we have not received the first number yet.
15. The old man looked out of his window one dark night and saw a crowd of boys and girls playing beside the bonfire.
16. The Indians fought fiercely, but the little band of white men pursued them with rifles and permitted none to escape.
17. The fisherman sinks his net in a deep pool and waits patiently till he can see the fish lying perfectly still in the clear water.
18. Some people think a desert is nothing but sand, but at certain seasons the desert of Arizona is covered with beautiful wild flowers.

Scoring.—Two points for each sentence correctly given. One point if only one word in error.

Test 8. Memory for Digits Reversed

7 1	2 5 3	1 6 2 9	9 5 7 1 3
5 3	6 4 9	8 3 7 4	7 6 2 9 8
2 8	5 8 2	3 7 6 1	5 4 9 3 1
9 6	5 1 7	8 6 2 5	2 5 7 9 6

9 5 3 8 1 6	2 1 4 6 3 8 7	4 7 2 9 3 8 1 5
2 4 1 6 3 7	9 4 1 2 8 3 7	7 1 8 3 6 2 5 4
8 6 3 7 4 5	8 5 3 7 9 4 2	9 2 4 7 3 8 6 1
9 3 5 8 2 6	7 3 8 6 4 2 5	8 6 9 7 1 3 2 5

Scoring.—One point for each series correctly repeated.

Test 9. Mental Arithmetic. (Arranged by Terman)

1. Making change, one purchase.
    - a. 10c.—5c.
    - b. 20c.—14c.
    - c. 25c.—12c.
    - d. 50c.—35c.
    - e. $1.00—63c.

2. Making change, two purchases
    - a. 10c—4c. and 3c.
    - b. 20c.—2c. and 5c.
    - c. 25c.—10c. and 6c.
    - d. 50c.—5c., 15c. and 10c.
    - e. 50c.—12c., 7c. and 8c.

3. Addition.

18	27	39	21	14
13	44	53	8	17
			13	25

4. A MAN SPENDS 2/3 OF HIS MONEY AND HAS $8 LEFT. HOW MUCH HAD HE AT FIRST?

5. A MAN'S HAT COST $2.50, AND HIS SHOES $2.00. WHAT WOULD IT COST TO GET HATS AND SHOES FOR 9 MEN?

6. IF JOHN HAD 15 CENTS MORE THAN HE HAS HE WOULD HAVE 40 CENTS. HOW MUCH HAS HE?

7. IF A TRAIN TRAVELS HALF A MILE IN A MINUTE, HOW FAR WILL IT GO IN AN HOUR?

8. WHAT NUMBER ADDED TO 16 GIVES A NUMBER 4 LESS THAN 27?

Scoring.—One point for each item under the first three tests and two points for each of the other tests.

Test 10. Finding Similarities. (Terman)

In what way are .... and .... alike?

1. A needle and a pin?
2. A pen and a pencil?
3. A nut and a banana?
4. A brick and a stone?
5. A watch and a clock?
6. A table, a chair, and a bed?
7. A hat, a coat, and a shoe?
8. Milk, potatoes, and candy?
9. A pair of scissors, a knife and an ax?
10. A lamb, a calf, and a child?
11. A ship, a bicycle, an automobile, a buggy, and a train?
12. A cat, a fly, a snake, a bird and a fish?
13. Water, blood, oil, milk, and ink?
14. Grass, cotton, an onion, a tree, and a thistle?
15. A dog, a tree, a bee, a fly, a turnip, and an eagle?
16. A farm and a factory?
17. An egg and a seed?
18. The eye and the ear?

19. Addition and multiplication?
20. A lake and an island?

Scoring.—One point for each.

Test 11. Giving Differences. (Arranged by Terman)

"What is the difference between," etc.

1. A cat and a hen?
2. A bucket and a basket?
3. The sun and the moon?
4. A hatchet and a hammer?
5. A nail and a screw?
6. A cigar and a cigarette?
7. A book and a newspaper?
8. A river and a lake?
9. A woman and a lady?
10. A lawyer and a judge?
11. A surgeon and an ordinary doctor?
12. A mistake and a lie?
13. Wealth and money?
14. An optimist and a pessimist?
15. A rascal and a thief?
16. Offense and defense?
17. Anger and rage?
18. Joy and satisfaction?
19. Revolution and rebellion?
20. Vice and crime?
21. Morality and religion?
22. The most important difference between an animal and a plant?
23. The most important difference between a mosquito and a sparrow?

Scoring.—One point for each.

Test 12. Naming Opposites. (Selected)

1. high
2. rich
3. day
4. north
5. love
6. empty
7. laugh
8. less
9. war
10. friend
11. forget
12. best
13. advance
14. sell
15. succeed
16. sure
17. injurious
18. suspicion
19. silly
20. miser
21. from
22. result
23. resemblance
24. reckless
25. vertical
26. conservative
27. impoverish
28. transparent
29. chaos
30. whither
31. unless

Test 13. Absurd Pictures. (Terman)

In 1914 one of the writers devised a set of absurd pictures. He was not at that time acquainted with the Rossolimo test of this kind. The idea of using absurd pictures as a mental test was suggested by a picture puzzle in a boy's magazine. This picture represented a house and a large number of surrounding objects, many of which were so drawn as to contain an absurdity. A prize was offered for finding all the absurdities. From this as a basis, the following absurd pictures were arranged by Terman with the help of Dr. J. Harold Williams:

1. A cat with only two legs.
2. A man with arms attached to head.
3. A man with feet and hands interchanged.
4. A man with feet pointing backwards.
5. A man with three legs.
6. A horse hitched to cart backwards.
7. A clock face, numbered backwards.
8. A hand with five fingers and one thumb.
9. A man writing, pencil inverted.
10. A schoolroom full of children, all writing with the left hand.
11. A man on horseback, seated facing the horse's tail.
12. A man shooting at a rabbit, pointing the stock instead of the muzzle at the rabbit.
13. A small chick and a hen on opposite ends of balance scales, the chick's end of the balance lower as though the chick outweighed the hen.
14. Doves by a dovecote. The doves far larger than the door of the cote.
15. A dog running away from a rabbit.
16. A man smoking a pipe, the bowl of the pipe inverted.
17. An apple with a pencil thrust through it; all the pencil visible.
18. Profile view of a face, both eyes showing.
19. A man sawing wood, saw teeth up.
20. A man sawing a branch off a tree while seated on the outer end of the branch.
21. A very fat man sitting on a small twig of a tree, the twig not bending.
22. A boy blowing out a candle, the flame of the candle pointing toward instead of from the boy's mouth.
23. Mice playing in a friendly way around a cat.
24. A man swimming, the entire body showing above the surface of the water.
25. A man sprinkling his lawn while it rains.
26. A house burning. The firemen have placed ladders and hose but sit idle on the ladder, one smoking a pipe, the other reading.
27. Two men sitting in a chair-swing. The rope which is supposed to hold up the seat is not attached but is held in the hands of the men seated in the swing.
28. The show window of a clothing store, containing articles labeled with absurd prices (hat, $45.00; suit, $1.00, etc.).
29. The "strong man of the circus" standing on a board and lifting himself in the air by pulling up on the ends of the board.
30. A house; the smoke, the tree tops, and the clothes on the line all being blown in different directions by the wind.
31. A house with a shed roof, the rain trough being (a) on the high side of the roof, and (b) sloped away from the rain barrel.
32. A woman in the rain, holding an umbrella far back over her shoulder while the rain strikes her full in the face.
33. A schoolboy with beard.
34. A girl wearing furs, but barefooted.

35. A man weighing himself while holding a heavy bundle of books under his arm.
36. A man on horseback, carrying on his own shoulder a bag labelled "100 lbs." Below is the inscription, "Helping his horse carry the load."
37. Sun low, man walking, shadow on wrong side.
38. A man on the road, nearer is a dwelling. The man is taller than the dwelling.
39. A man dragging an elephant. Elephant is braced back but is sliding forward as the man pulls.
40. A white man being attacked by three Indians. Two are near him with tomahawks poised in the air, but the white man is shooting the third one, who is far off.
41. A buggy running through mud, the mud being hurled off the wheels backward.
42. Sun is low, clock on a tower indicates noon.
43. A man dragging a dog forward with a rope around his neck, dog resists but rope is slack.
44. A man and woman sitting out in the yard while it rains. The man is smoking, the woman knitting.

Scoring.—One point for each.

Test 14. Absurdities and Incongruities of Statement

1. I got to the house just in time to see a mouse chasing the cat out of the cellar. (Terman.)
2. A chicken's front legs are nearly always about two inches shorter than its hind legs. (Terman.)
3. Walter now has to write with his left hand because two years ago he lost both his arms in an accident. (Terman.)
4. Because Bessie's eyes are weak and the light hurts them, she has to read her lessons every night in the dark. (Terman.)
5. I saw a nicely dressed gentleman on the street. He had his hands in his pockets and was twirling his cane. (Binet.)
6. A wheel came off of Frank's automobile and as he could not get the wheel back on he had to run his automobile to the shop for repairs. (Terman.)
7. Though armed with nothing but his pocket knife, he killed the robber with a single shot. (Simpson.)
8. While walking backwards he struck his forehead against a stone wall and was knocked insensible. (Simpson.)
9. An Irishman called at the post-office to get his mail. "What is your name?" said the postmaster. "Why," said the Irishman, "You will find my name on the envelope." (Terman.)
10. The storm which began yesterday has continued three days without a break. (Simpson.)
11. An old lady says that God is very good because He always makes the largest rivers flow past the largest cities. (Terman.)
12. One day we came in sight of several icebergs that had been entirely melted by the warmth of the Gulf Stream. (Simpson.)
13. They found the young man locked in the room with his hands and feet tied behind him. They think that he locked himself in. (Huey.)
14. The poor sick man lay flat on his back six weeks in the month of August and suffered terribly. (Terman.)

15. Henry's dog has three puppies, and so when Henry builds a little house for them he will have to make one large door for the mother dog and three small doors for the three puppies. (Terman.)
16. Everyone knows that a pint of cream weighs more than a pint of milk. (Adapted from Simpson.)
17. John was saddling his horse one day and thoughtlessly put the saddle on backwards. When told of his mistake he said: "How do you know which direction I am going to ride?" (Terman.)
18. In some states there are laws to prevent a man from marrying his widow's sister. (Simpson.)
19. As we walked eastward in the moonlight my friend pointed out the North Star clearly visible on our right. (Simpson.)
20. In an old graveyard in Virginia they have discovered a small skull which is believed to have been that of George Washington when he was about ten years old. (Adapted from Simpson.)
21. The worst of all crimes is murder, but it is worse still to torture a helpless babe by burning out its eyes and tongue without killing it. (Terman.)
22. The hands of the clock were set back so that the meeting might surely close before sunset. (Simpson.)

Scoring.—One point for each.

Test 15. Picture Interpretation

1 to 3. The three pictures used by Bobertag.
4 to 6. Three Jingleman-Jack pictures:
  (a) Janitor chasing children downstairs.
  (b) Carpenters building a house.
  (c) Plumbers fixing pipe, water breaks loose.
7. Child eating, dog begging food.
8. Dog on the beach, child lying near; dog has just dragged child from water.
9. Children loaded with presents bidding Santa Claus farewell.
10. Children playing at war.
11. Girl at well; has dropped pitcher, which lies at her feet in fragments.
12. Kittens excited at sight of a tail projecting from under some papers on the floor.

Scoring.—0 to 5 points for each, according to amount of description and interpretation.

Test 16. Resourcefulness

(Arranged by Terman. Suggested by Binet "comprehension" test.)

1. What's the thing to do when you are tired?
2. What's the thing to do when your face is very dirty?
3. What's the thing to do when you are riding in a carriage and the wind blows your hat off?
4. What's the thing to do if you find some money on the floor of the schoolroom and you don't know whose it is?
5. What's the thing to do if you have no umbrella and it begins to rain hard when you get nearly to school?
6. What's the thing to do if you are throwing your ball and accidentally hit a lady who is passing by?

7. Suppose you live two miles from the schoolhouse and you find when you get nearly to school that you have forgotten your lead pencil. What should you do?
8. What's the thing to do if you are alone in the woods far from home, and a savage bull chases you?
9. What's the thing to do if you go to sleep on the train and do not wake up until you are several miles past the station where you wanted to get off?
10. The cows have been eating the corn in the man's field. Name all the ways you can to stop it.
11. Suppose you have a bucket full of eggs in one hand and an empty basket in the other, and a man offers to give you some nice sweet cider. How could you get it home?
12. What would you do if a person who you know is crazy calls you ugly names?
13. Suppose a boy has earned 5 cents and is carrying it home to his mamma, who is sick and has no money. On the way a little child stops him, cries, and asks for some money to buy candy. What should the boy do?
14. What would you do if you were to get lost in a large forest and did not know what direction to go?
15. A man wants to catch a kitten, but the kitten runs up a tall tree which no person can climb. How can he get the kitten without hurting it?
16. Suppose a man is shipwrecked on a little island where there is nothing to eat, but he manages to save from the wreck a few potatoes, some milk, some nuts and some eggs. He does not know how soon a ship will come to rescue him. What should he eat first? *He has a few potatoes, some milk, some nuts and some eggs.* (After answer, say "what next?" "And next?")
17. Suppose a doctor while hurrying to see a patient who has been dangerously hurt, comes upon two dogs fighting. What's the thing for him to do?
18. Suppose you are driving along a lonely, deserted road and you find a man who has been dangerously hurt in an accident. The man wants to be taken to the hospital, but your carriage is already so full of people that not another one can crowd in. It may be hours before any one else comes along to help, so what would you do?
19. Suppose you are driving a wagon load of lumber and the wagon gets stuck in such a deep mud hole that the horses cannot possibly pull the load out. If there was no way to get help, what would you do?
20. Suppose you were to find a two-year-old child lost on the streets of a large city. You cannot find the parents and you do not know where the child lives. What would you do?
21. Suppose a heavy timber falls on the foot of your playmate and holds him fast. The timber is so heavy you cannot lift it and there is no way to get help. What would you do?
22. Suppose you have to write a letter or be killed. You have paper, but no pen, ink or pencil. What would you do?
23. Name all the ways you can in which a person can get a big reputation.
24. Suppose you find on the street a letter which is addressed, sealed and stamped but has not been mailed. What would you do with it?

25. (E. lays 6 pieces of paper, 1" x 3", on the table in a row facing S, and hands S a pair of scissors.) Cut all these pieces of paper in two just as quickly as you can. (S should cut all at once, not one by one.)

Scoring.—Elaborate rules were worked out for scoring this test. One point was given for each satisfactory response, with half credits for responses below the best.

Test 17. Finding Reasons. (Arranged by Terman)

1. Give all the reasons you can why children should not talk and "cut up" in school.
2. Give all the reasons you can why children should obey their parents.
3. Give all the reasons you can why a young man should not get drunk.
4. Give all the reasons you can why a man who commits a serious crime should be punished.
5. Give all the reasons you can why a young man should not spend all the money he earns.
6. Give all the reasons you can why city streets should be well lighted at night.
7. Give all the reasons you can why most people would rather have an automobile than a buggy.
8. Give all the reasons you can why one should get a good education.
9. Give all the reasons you can why a country should have plenty of railroads.
10. Give all the reasons you can why some people use typewriters which cost $100 when they could get pens, ink, and penholders for only a few cents.
11. Give all the reasons you can why we should not give something to everyone who begs.
12. Name all the things you can that help to make a nation great.
13. Why should we forgive a wrong act committed in anger more readily than a wrong act committed without anger?

Scoring.—To secure a basis for scoring, the "good" reasons were listed for each test. Usually there were from three to six deemed "good." Then a test was scored one point for each good reason given.

Test 18. Sentence Completion. (Trabue, Scale C.) Given and scored according to author's directions.

Test 19. Sentence Building. (Adapted from Masselon)

1. sky, red.
2. sun, noon.
3. water, hill.
4. teacher, pleased.
5. pen, ink, letter.
6. boy, string, kite.
7. carpenter, house, lumber.
8. pipe, match, smoke.
9. needle, thread, button, coat.
10. hunter, gun, forest, rabbit.

11. man, wood, stone, warm.
12. train, night, accident, bridge.

Scoring. –One point for each. One sentence or two coordinate clauses.

Test 20. Disarranged Sentences

1. DOG THE RUNS
2. HOT SUN IS THE
3. HARD VERY IS RAINING IT
4. SHORT LEARNED IS QUICKLY LESSON A
5. DOES ANGRY NOT TO IT GET PAY
6. ACTIONS CAN A WE MAN BY JUDGE HIS
7. WITHOUT NOT IS BECOME TO IT EASY RICH WORKING
8. TO WORSE BEFORE ATTEND IT TROUBLES GET TO THEY PAYS
9. PASSENGERS THE CRASHED ALL SHIP A AND AGAINST DROWNED WERE ROCK THE

Scoring.—One point each.

Test 21. Ball and Field Test. (Treman)

Like the Stanford Revision test, but with five fields, each of a different shape. The first is a circle, the second a square, the third a rhombus, the fourth an ordinary cross, and the fifth a Maltese cross. This method made possible a finer gradation of the performance than is possible in the regular Stanford Revision test.

Scoring.—One point for "inferior plan," two points for "superior plan," for each of the five fields; total possible credit, 10 points.

Test 22. Finding the Shortest Road. (Terman)

Cuts were made representing city blocks and streets. Two distances were shown and the subject was asked to find the shortest road from one of these points to the other. The series contained nine tests. In each the shortest distance was readily discriminable from other possible routes by ordinary observation and single calculation.

Scoring.—One point for each of the nine tests of the series.

The following table shows the correlation of each of these tests with Stanford-Binet mental age and their correlations with one another. The correlations were computed by the Spearman Footrule and then converted into r values by the Pearson conversion table, based on:

$$r = 2 \cos \frac{\pi}{3} (1-R)-1.$$

It is believed that the 484 correlations which the table contains should prove of decided interest to those who are concerned about the analysis of mental abilities and their relationships.

INTERCORRELATIONS OF THE TESTS

	Mental Age	1. Pict. Naming	2. Oral Reading	3. Origins	4. Time Orient	5. Direct Orient	6. Spacial Concepts	7. Mem. of Sent.	8. Digits Reversed	9. Mental Arith.	10. Similarities	11. Differences	12. Opposites	13. Absurd pict.	14. Absurd Statements	15. Pict. Interp.	16. Resourcefulness	17. Finding Reasons	18. Completion	19. Sentence bldg.	20. Mixed Sent.	21. Ball and Field	22. Shortest Road	Average
Mental Age		72	83	84	81	84	77	73	75	69	81	90	89	89	90	78	80	90	84	64	86	70	59	.794
1. Pict. Naming	72		41	77	55	44	46	55	46	63	84	78	71	73	72	78	77	65	90	73	35	85	41	.646
2. Oral Reading	83	41		65	62	59	58	53	47	51	61	68	74	62	72	59	47	74	74	37	78	63	43	.605
3. Origins	84	77	65		78	44	61	67	51	76	77	84	77	82	77	80	83	80	70	58	62	64	23	.689
4. Time Orient	81	55	62	78		76	80	64	63	69	80	70	74	84	81	61	71	74	67	65	73	53	47	.694
5. Direct Orient	84	44	59	44	76		77	57	36	73	69	62	76	78	78	47	61	72	70	64	74	49	59	.641
6. Spacial Concepts	77	46	58	61	80	77		71	49	85	74	63	77	82	74	58	67	78	63	57	77	51	53	.672
7. Mem. Sent	73	55	53	67	64	57	71		59	61	74	65	71	73	75	65	59	70	70	65	59	50	38	.635
8. Digits Reversed	75	46	47	51	63	36	49	59		68	50	70	61	65	72	58	59	58	53	51	64	58	47	.574
9. Mental Arith	69	63	51	76	69	73	85	61	68		69	73	81	83	83	61	73	79	68	53	73	59	62	.696
10. Similarities	81	84	61	77	60	69	74	74	50	69		77	84	85	84	67	81	76	79	61	76	62	34	.724
11. Differences	90	78	68	84	70	62	63	65	70	73	77		77	73	86	77	69	84	65	57	70	64	53	.716
12. Opposites	89	71	74	77	74	76	77	71	61	81	84	77		89	92	76	75	82	85	58	73	65	61	.758
13. Absurd pict	89	73	62	82	84	78	82	73	65	83	85	73	89		91	71	84	81	74	65	81	72	65	.774
14. Absurd statements	90	72	72	72	81	78	74	75	72	83	84	86	92	91		75	86	86	88	63	72	70	53	.779
15. Pict. interp	78	78	59	80	61	47	58	65	58	61	67	77	76	71	75		74	84	68	65	54	65	37	.662
16. Resourcefulness	80	77	47	83	71	61	67	59	59	73	61	69	75	84	86	74		78	67	63	64	68	54	.700
17. Finding Reasons	90	65	74	80	74	72	78	70	58	79	76	84	82	81	86	84	78		77	55	74	65	50	.742
18. Completion	84	90	74	70	67	70	63	70	53	68	79	65	85	74	68	68	67	77		62	79	44	51	.704
19. Sentence bldg	64	73	37	58	65	64	57	65	51	53	61	57	58	65	63	65	63	55	62		34	46	35	.568
20. Mixed Sent	86	35	78	62	73	74	77	59	64	73	76	70	73	81	72	54	64	74	79	34		61	69	.676
21. Ball and Field	70	85	63	64	53	49	51	50	58	59	62	64	65	72	70	65	68	65	44	46	61		59	.610
22. Shortest Road	59	41	43	23	47	59	53	38	47	62	34	53	61	65	53	37	54	50	51	35	69	59		.496

A NEW PICTURE COMPLETION TEST[1]

By Edwin A. Shaw, Tufts College

In organizing the series of tests which bears their names, Binet and Simon recognized as a fundamental principle that the degree of a person's intelligence is exhibited in the extent of his ability to find solutions for the various situations with which he is confronted. The nearer the situations devised for testing purposes come to those of real life, the more accurate will the results of the measurement be.

The following quotations will show the opinions of Binet and Simon[2], in their own words:

" . . . These intellectual acts consist in understanding, judging, explaining, defining, developing, inventing, imagining, deducing, demonstrating and in accomplishing a host of other operations which have for their object directly or indirectly the solving of problems." (p. 97)

" . . . Every thought is like a key which must fit exactly in the hole of some lock." (p. 141)

"When it is a question of new action, the adaptation does not take place immediately at the first attempt but by gropings, that is to say by successive trials; one is like a locksmith called to open a locked door; he searches in his bunch of keys and tries many but he does not try them all indiscriminately, *for he sees at a glance those that will not fit; his attempts are* not blind, they are directed, selected, according to a complex mechanism." (p. 142)

It is possible, by means of construction and performance tests, to duplicate many of the situations which are the basis of the verbal methods of testing employed in the Binet-Simon, Trabue, and other similar series of tests. These tests not only lessen the emphasis placed on linguistic abilities (which is a recognized fault of the Binet-Simon method), but they are a necessity in the testing of the deaf, dumb, the foreign-born, and the children whose grasp of the English language is limited by the influence of their environment.

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[1] From the Laboratory of Educational Psychology, Harvard University. Communicated by W. F. Dearborn.

[2] Binet and Simon, "The Intelligence of the Feebleminded" (translated by Elizabeth S. Kite), *Publications of the Training School at Vineland, New Jersey*, Department of Research, Number 12, June, 1916.

Further, it is often possible to make the situations in construction and performance tests approach more nearly to the actual situations which the child encounters in his daily life, thus greatly increasing the interest of the child in the test. In certain schools where the Binet test has made but an indifferent appeal to pupils and teachers, the performance tests have been received with open arms, and in some cases it has been necessary to choose the subjects by lot, so great is the desire on the part of the pupils to try the tests.

Many of the ninety tests included in the present Stanford Revision of the Binet-Simon Series find their counterparts in performance tests. Notable among these are the tests involving the pictures, the tests involving memory for shape and form, and the tests calling for discrimination of color and form, The "comprehension" tests are answered by the action instead of by mere words. The "similarities" and "differences" appear in the performance tests in several ways, each calling for a "motor" answer. The "absurdities" find their prototypes in the ridiculous "insets" in the Picture Completion Tests, and in the latter the question is always apparent to the child, and his answer is either correct or incorrect. There is no chance for a misunderstanding due to the incoherent utterance of the examiner or the lack of ability to read on the part of the pupil.

The "problems of fact" are much more naturally given with the "Picture Completion" Test, as in the latter real problems which touch every child's life are presented, and the pupil is working with familiar material.

"Mutilated pictures" and "aesthetic comparison" tests, "familiar objects" and "definitions" may find definite vehicles for expression in performance tests.

The abilities measured by the "sentences" in the Binet and the supplying of the missing words in the Trabue Scale are easily and accurately measured by the performance tests. "The three R's" have no influence on the result, the scoring is on an objective basis, and the child will almost invariably give his best answer, as he can readily understand the problem and he is cognizant of the fact that his answer depends on the quality of his action alone.

In the last analysis, the chief office of all mental testing is to furnish a means by which the examiner may get "under the skin," through the "veneer of civilization," of the child, and in the performance test we find an easy mode of approach. The child loses his embarrassment in the presence of a strange examiner; he sees the goal, with no linguistic obstacle intervening, and as piece by piece he builds his result, he gains confidence.

While certain children fail to receive the credit which they deserve because they "must learn by doing," on the other hand certain individuals find it possible to reach the Freshman class in college on the strength of their skill in handling words, although they are unable to meet and solve successfully common situations in their daily lives. In one case which came under my observation, a man doing fair work in his first year at college failed utterly with the Picture Completion Test described below. There are doubtless other factors which need to be taken into consideration in explaining the result, but investigation showed that while he possessed a remarkable memory, he translated little of his "knowledge about" into "knowledge of" the world in which he lived. He seldom "suited the action to the word."

Children in the first grade sometimes make splendid records in performance tests, in which some college students have been known to fail.

The results of performance tests raise anew the long-standing criticism of our system of education in that it places altogether too much emphasis on the linguistic side without sufficient recognition of the child's "motor" needs. Some individuals may think and reason without any very definite verbal concepts. They seem to be "motor-minded," and with them action comes before words. An illustration of this "motor-mindedness" is found in the case of the Canadian of French-Indian blood, one of the twelve stalwart sons of a full-blooded Indian. Although not one of the sons can "read, write or figure," they are all successful business men or farmers. The first mentioned employs thirty or forty masons on large construction jobs. His estimates are always accurate, and he clears good profits without an account book of any kind. Such a man would make a bad failure with the Binet or a similar test, but with the performance test he is likely to do well.

The performance test encourages the child to believe in himself, and it seems to cause the adult to examine his own abilities and more carefully adjust himself to his niche in this world. Properly used, the performance tests will throw a new light upon some of the "hard cases" in the schools, and it behooves every wide-awake school man to study this question, to ascertain what there is in it for him and for his school.

There are a number of respects in which the performance tests now in use may be improved in order to approximate more closely the general methodology which has established itself in the more successful of the tests which depend upon language ability. These considerations demand attention to a number of details which sometimes seem to be, in themselves, of insignificant or minor importance, but which are necessary to the development of a successful test.

The problems involved in the construction and use of a new picture completion test, which it is the chief purpose of this article to describe, will illustrate the considerations above mentioned. In the development of this test it seemed desirable to find a picture which should have a unity such as does not characterize other tests of like nature. A large number of pictures showing complicated situations were analyzed and dicussed, and finally a drug store was chosen as the basis of the picture to be used. Nearly every town or city has its drug store with which children and adults are more or less familiar. The drug stores, also, are tending to take on much the same type of appearance with the development of the chain store idea. An endeavor was made to gain a sort of conception of

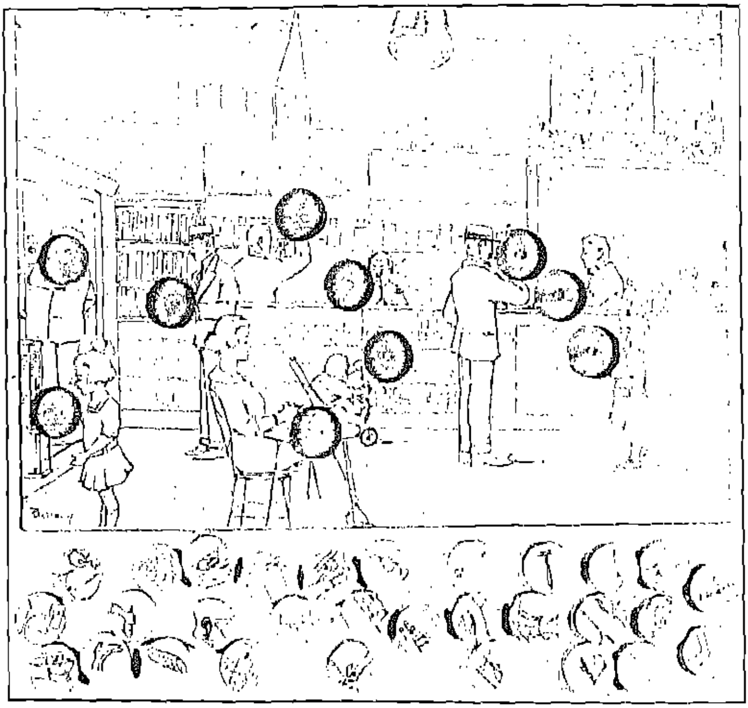


FIG. 1

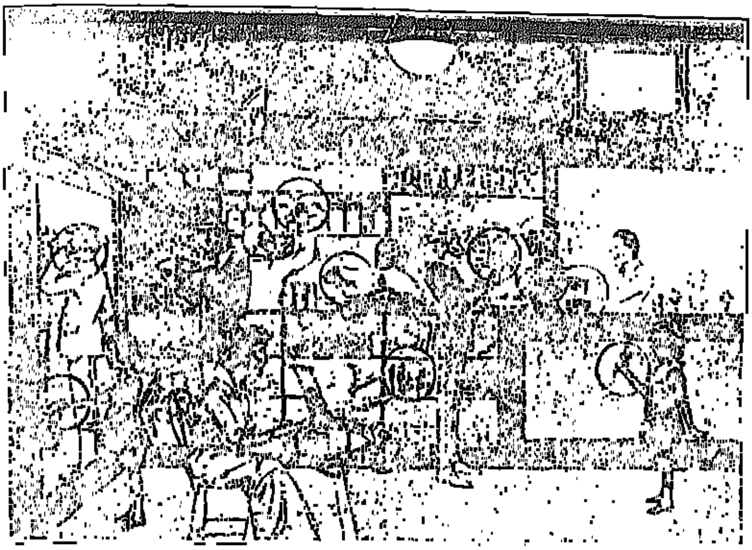


FIG. 2

what "drug store" means to the average individual. Attitudes and motions of clerk and customer were as far as possible noted, and a sketch of the picture shown in Figure 2 was made. After further study and analysis of the various situations, the final arrangement of the picture, as shown in outline in Figure 1, was made.

Much care was exercised in choosing an artist since the picture must not be found open to the criticism of poor draughtsmanship, since older children almost invariably are led to hold a test lightly which is based on a picture poorly drawn, and it has been noticed that adults have been particularly interested in this picture because of the good workmanship involved. The insets were made circular in shape and of a standard diameter, in order to obviate the misconception involved when children try simply to fit in the blocks instead of completing the situations.

For each of the ten situations selected, every one of which involves action and is peculiar to the drug store, a second inset was devised which should have some of the elements of the correct situation but which should not fit as well as did the Number 1 inset. Then ten other insets were chosen which should have no connection with the drug store. These insets were changed again and again, until every ambiguity noticed was removed. The blocks were made a bit thicker than the depth of the holes in the backing of the picture, so that the blocks might be readily removed. Each hole was left a little higher in the center, so that the blocks might be tilted and thus removed more easily. Choosing then a tentative set of directions, the picture test was given to some eighty children between the ages of eight and twelve, and the results carefully studied. Then it was found that some of the insets were not yet adequate and that a few of the figures on the picture could be changed and thus greatly improve the clearness of the picture. In making the necessary changes, it was also thought desirable to have the new picture reproduced in color, and then to the thirty insets already used, ten blanks colored to match the foundation color of the picture, were added, making forty insets in all.

Figure 2 shows the picture with the correct insets in place, numbering the insets from one to ten beginning at the lower right hand corner. The first inset contains a cone of ice-cream; the second one, a glass, being filled with orangeade; the third, a lighted match; the fourth, ball and dolls; the fifth, part of a scale and a scoop; the sixth, a bottle, tilted, containing a liquid; the seventh, a dish of ice-cream; the eighth, a book; the ninth, a hand with a coin; the tenth, a telephone

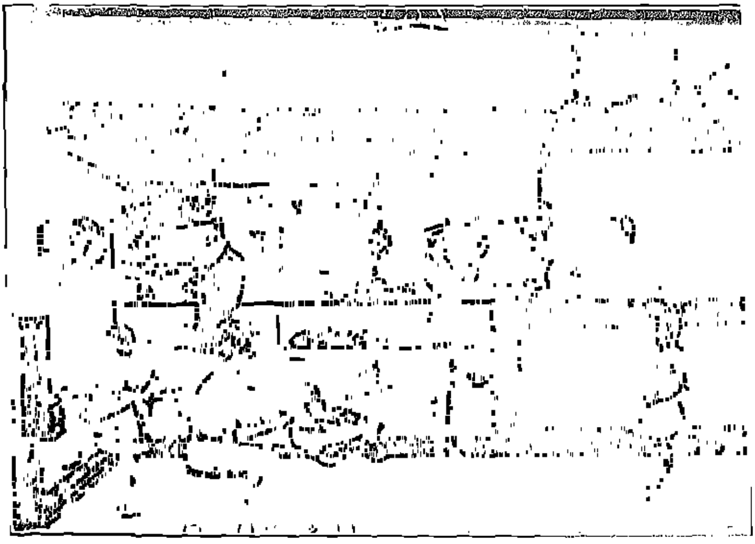


Fig. 3

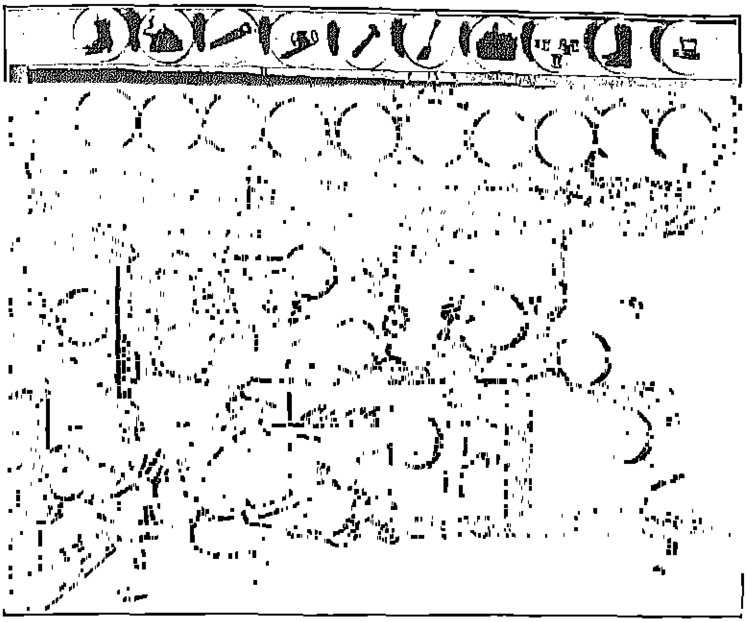


Fig. 4

receiver. Figure 3 shows the picture with the second set of insets in place again beginning at the lower right hand corner. The first inset is a piece of soap; the second, a plate to receive the soda; the third, a glass of water to light the cigar with; the fourth, some pipes; the fifth, a bottle containing liquid and a part of the scale; the sixth, an upright bottle containing solid matter; the seventh, a cup of steaming chocolate; the eighth, a box of candy; the ninth, a hand with a dollar bill; the tenth, an ear trumpet. It will be noted that each one of this set fits the situation less perfectly than does the corresponding piece in the first set. Figure 4 shows the ten blank insets, and also the ten insets which contain no suggestion of "drug store."

With these developments, it is believed that most of the difficulties in the construction of picture completion tests have been satisfactorily met, as the children no longer attempt to fit blocks, an opportunity to grade the performance in each situation has been provided, and each block can be removed from any hole without putting the fingers through the back. Fifty adults who tried the test did not seem to find it silly or childish at first sight, and most important of all, the unity of the picture, in which each situation was a constituent part, was apparent.

In giving this Picture Completion Test, the directions to the examiner were as follows: Place the board before the subject, taking your position at the opposite side of the table. Open the box containing the blocks, and place it at the subject's right hand. Then begin at once to give the following instructions: "This picture is not complete, as you see. You will find the missing parts there (pointing to the open box). Of course you can't use all the blocks in the box, but you may be sure that the proper block for each space is in the box. You may use one or both hands, and you may change the blocks around as much as you wish. Work as quickly as you can, and tell me when you have finished it. Do you understand?" Then start the stop watch. Note the manner in which the subject attacks the problem and record the number of each block used, in the spaces provided on the record sheet (the holes being numbered from one to ten beginning at the bottom and at the right of the picture, the blocks taking the numbers of the holes in which they fit the situation for the first set of ten, the next set of ten taking the numbers of the holes with an "A" added, as "3 A," the blocks which have no drawing on them being recorded as "W," and the rest of the blocks taking the name of the objects drawn on them). When the individual indicates that he has finished, stop the watch and record the time elapsed. Filling all the holes does not, of course, constitute the completion of the task. It is finished when the individual can see no more changes that he cares to make and says that it is done. Then ask, unless he has mentioned the name of the picture during the performance, "What is this a picture of?" Record the answer. Then ask "Why do you say that?" Record the answer. Then say "What season of the year is it" and "why?" If the subject hesitates, check the word "afterwards" on the record sheet. If he has mentioned the name before, check the word which will indicate that fact. Score by allowing ten for each hole correctly filled; five for each hole filled with the second choice (i. e., 3A merits 5); three for any one of the first or second choices misplaced (for instance, 2 or 2A in number 5 hole); score zero for a hole left vacant, minus two for a blank block in any hole; and minus three for any of the set of ten blocks which have no connection with the "drug store."

Record the results on blank similar to the following form:

School ....Grade ....
Name ....
Age (yrs. and mos.).............Boy or Girl............
Teacher ....
Picture Completion Test (Color)
Time ....1.......2.......3.......4........5........
Score ....6.......7.......8.......9.......10........
Remarks ....
....
....
Whole idea, at first, mid-way, at end, afterwards.
What is it a picture of?...............Why?.............
What is the season?..................Why?.............

The Picture Completion Test, following the method indicated, has been given to about ninety children between the ages of eight and twelve years inclusive. The results to date of the standardization of the test are given in Table I.

TABLE 1

Picture Completion Test.

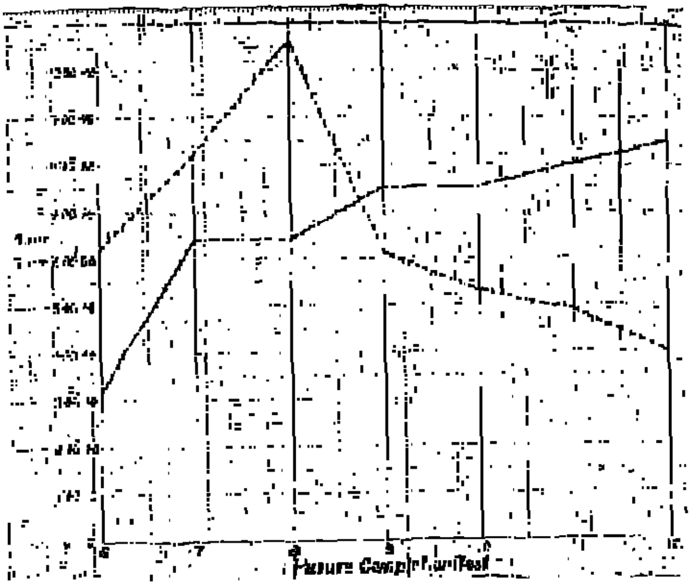
Age	6	7	8	9	10	11	12	Adult
Median Score=	32	64	64	75	75	80	85	75
P. E.	(11)	(16)	(18)	(5)	(10)	(7)	(5)	(12)
Median Time=	6-10	8-14	10-35	6-05	5-20	4-54	4-00	4-33
P. E.	(1-10)	(2-14)	(3-15)	(2-15)	(2-05)	(1-10)	(1-00)	(1-05)

Table 1 shows the median scores and median times in minutes and seconds for the performances of children of the various ages. It is to be noted that the adult score (fifty cases) does not indicate a better performance than that of the older children.

In Figure 5 the relationship existing between the score and the time, between the years eight and twelve, where we have a reasonable number of cases, is clearly shown. The score increases as the time decreases. The score line as a whole shows a decided improvement with age, and without doubt the younger side of the time line will show up as well when we have obtained a larger number of cases. We may expect a normal child of ten years to make a score of seventy-five in five minutes or less time.

The range of performance is made large by some exceptional cases, but the " norm " is *probably sufficiently indicated* by the number of cases thus far tabulated. Some of the exceptional cases may be mentioned.

The college Freshman above mentioned seemed unable to



Score: ———— Time: …………

FIG. 5

see any unity to the picture, and in the majority of the depressions he placed insets chosen at random. He seemed unable to associate the different elements of the situation and secured a very low score (twenty-two) in a very long time (fifteen minutes). This disconcerting result led to other inquiries in regard to the student which are not pertinent to this discussion.

On the other hand, certain very young children made excellent scores in comparatively short times. The comments of one little girl may be added: "Now what do you s'pose the baby wants?" Again, "Now if I put that chocolate in there, it will be winter, but this ice cream will make it summer, and that's what I want it to be." "He wouldn't light his cigar with a glass of water." "He wouldn't be turning orangeade into a plate. Oh, I see, there's the glass." "I guess she'd rather eat a cone than eat soap." Monologues more or less like the above were heard on many occasions.

Even with some of the children who were considered by their teachers to be dull and unintelligent, we discovered a decided tendency to analyze the various situations first and then deliberately set about to find the block which best answered the conditions. They were interested and eager to try the test, and the teachers seemed to be willing to give considerable credence to the findings obtained. The test is proposed as one of a series of performance tests to supplement tests now in common use; the partial standards already obtained seem to indicate that it may at least be depended upon to furnish valuable supplementary evidence.

A PROGRAM FOR A PSYCHOLOGY OF LITERATURE

By June E. Downey

What may be done in the way of devising special tests for both vocational and avocational guidance has been excellently demonstrated by the musical talent chart so effectively elaborated by Professor Seashore and his colleagues. In a similar fashion tests should be standardized for determination of literary ability. Such material could be utilized to good purpose in giving advice to the college student in general and to the student of journalism in particular. A program for investigation with such an end in view I have found precipitated in my experience in conducting courses on Literary Esthetics and English Composition,—the latter including work with the Short-Story.

For convenience this program may be considered under four main heads:

I. General psychological points of view significant for literary criticism and comprehension of the different forms of literary production.

II. A listing of a few of the possible experimental investigations that have a specific application to the psychology of literature.

III. Suggestions as to possible diagnostic tests of literary ability.

IV. Consideration of possibilities in the way of stimulating literary invention by utilization of devices for initiating and controlling imaginative work.

I. General Points of View and the Psychology of Literature.

In consideration of psychological theory, the most important item is, probably, the relation of the instinctive life to character-creation and to plot-structure. Here the Freudian and allied psychologies afford many tempting points of departure which need not be rehearsed at this time as recent expositions will suggest themselves to every reader. But technical studies of the various methods of creation of characters from the stuff furnished by life are yet to be made. Such methods include fusion of two or more personalities into one; or splitting of a character into two, as Dickens split his father into Micawber and Turveydrop; or doubling of a character so that the same trait is variously personified. The varying skill of authors in delineation of men and women characters also deserves a fresh review in the light of modern sex psychology, particularly psychic bisexualism.

The recent recasting of the logic of the emotions with its illuminating discussion of emotional displacements and transfers; of effective compensations and diffusion of moods, is also most promising for a rationale of certain literary effects. A particular application occurs in the scrutiny of literary symbolism by Freudian and allied methods and the tracing of its analogies with dream-constructions. In fact, the whole field of the Unconscious in its relation to creative processes is being explored in a new and fruitful way.

Of course the enigma of the literary temperament is not permitted to slip into the background,—the newer points of view suggest so many tempting analogies, if not actual identifications, with states well known to the psychiatrist. The concept of Pathological Lying, for example, fairly teases one by its insistence upon recognition as a highly honorable and profitable departure from the normal, if utilized in a monetary and not a monitory way!

II. Experimental Investigations and the Psychology of Literature.

Under this general head we may cite in some detail experimental investigations which have a direct bearing upon the literary craft.

1. Mental Imagery. In broad outline one may include here the intensive studies that have been made of Mental Imagery, inclusive of both illustrative imagery aroused in the reader and the imagery that is inferred as present in the writer. Certain discussions relative to the value of the so-called Method of Style will be recalled in this connection with the resulting recognition of its limitations but also realization of practical possibilities inherent in a comprehensive application of it. So, too, certain conclusions concerning the most effective forms of literary suggestion have crystallized.

One outcome of experimentation on concrete imagery has been a growing realization that the old-time classification of images on the basis of sensory quality, visual, auditory, cutaneous, and the like, must for many purposes be superseded by classifications that emphasize other attributes of imaginal states, such, for example, as persistence versus evanescence; plastic versus diffluent qualities; abstractness versus particularity; spontaneity versus effortful control. The various possible localizations of the image, so thoroughly detailed by Dr. Martin,[1] are also of considerable importance from the standpoint of the literary craft.

The study of the image leads directly to a study of the imagination and to experimental investigations of the differences between the imagination and the memory image. In such investigations we come upon attempts to uncover the roots of the creative imagination and to list individual differences in methods of Invention, varying from the nakedly intuitional to the deliberately combinative. At present, we find a large appeal to biographic material but with hints here and there of possibilities in the way of experimentation.

The practical significance of individual differences in imagery processes is very evident when one approaches the matter from the angle of actual composition. In my work with students whose mental processes I have cross-sectioned I have grown accustomed to the hall-mark of certain imaginal predispositions.

For instance, I may cite a talented girl, preoccupied to an extraordinary degree with the sound qualities of the external world and the sound-images of the inner. This preoccupation is evident in composition in her choice of musical words, her sensitiveness to rhythmic and melodic effects, and her modulations of voice in reading her very charming sketches. With this auditory preoccupation—a preoccupation so intense that she winces at harshness of voice-quality or hardness of phrasing,—there goes a keen organic sensitiveness but only dim and fugitive visual images. Her stories are charming in style but vague in plot; her characters, who speak to her in varied voices, rarely cross the threshold of the visible. Her productions possess emotional but not dramatic nuance; and she finds it impossible to write a photoplay. She should excel in the personal essay and should be encouraged to try her hand at writing poetry. In contrast is a second student whose stories lack all charm of style but who shows amazing facility when asked to outline scenarios for moving-pictures, because, as she informs me, it is just in true photoplay fashion that her visualized characters perform for her on the stage of her mind.

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[1] "Die Projectionsmethode u. die Lokalisation visueller u. anderer Vorstellungsbilder," *Zsch. f. Psychol.*, 1912, 61, 321-546.

2. Inner Speech. The verbal image in its various forms has particular interest for the student of literature since it furnishes the actual stuff out of which literary dreams are made. The classification of its forms into auditory, vocal-motor, and auditory vocal-motor is assuredly not of theoretical interest only. Complete freedom of the auditory phase of inner speech is in my experience with reagents not common. Such freedom, when achieved, would seem to afford a basis for an almost infinite variety of auditory mimesis or dramatic impersonations. One might expect it to issue in great range of stylistic effects, particularly in character delineations that depend largely upon speech-rhythms and flexibility in accent and emphasis. On the other hand, when the inner speech is acoustic-motor the writer during the act of composition would seem to have a fairly distinct consciousness of himself as speaker or orator. With this distinct consciousness of agency there may go set personal rhythms that the reader appreciates to the fullest extent only when hearing the writer read aloud his own compositions. In my experience the individual employing auditory-kinesthetic inner speech with its personal coloration has frequently shown oratorical gifts that may be lacking in the individual whose internal phrasing is more purely auditory, although if the latter be dramatically gifted his imitation of the inner voice may achieve a range of variation quite beyond the capacity of the less detached creator. Often the individual whose inner speech is purely kinesthetic exhibits an insensitiveness to harsh combinations of sounds that limits very decidedly his stylistic achievements. His relatively slight preoccupation with auditory nuances, even on the sense-level, is often evidenced by his colorless and characterless reading aloud and his confession that he has no notion at all of what his own voice sounds like or his description of it in ludicrously false terms. When he desires enforcement of the sound of words he is apt to have recourse to actual reading aloud. There may, however, exist with the vocal-motor internal speech a sensitiveness to kinesthetic ease that will lead in composition to a choice of word-combinations that may be rapidly enunciated and so develop a style of great rapidity and fluency.

3. Stylistic Details. Allied to the investigations of Inner Speech are experimental expositions of such literary devices as assonance, alliteration, onomatopoiea and the like. Much remains to be done. Thus onomatopoiea has been considered chiefly from the auditory side, as a verbal imitation of natural sounds. But other forms exist, such as imitation of gustatory

and cutaneous effects by vocal devices; suggestion of emotional tempos by kinesthetic rhythms; and conveyance of mood qualities through employment of vowels of the proper pitch and timbre. Experimental tests of the varying affective values of different vowels and consonants have been made by Roblee and Washburn,[2] and by Givler.[3] The latter has made an extensive study of the psycho-physiological effect of speech elements as mere tones apart from their setting in a meaningful scheme of sounds and sought to determine the motor and emotional value of the characteristic tonal patterns of a number of English poets.

A report "On the Psychological Response to Unknown Proper Names" is reported by English and Alpach,[4] a bit of research motivated by a desire to determine the amount and kind of imagery called out by proper names and to test Claparède's suggestion that Word-Physiognomy plays an important part in determining visualization of unknown persons. A companion study by de Laski [5] details Dickens' methods of obtaining and applying names to characters. An almost unlimited field of work is suggested by such studies.

Investigation of other stylistic details also deserve consideration. Many of the suggestions embodied in Spencer's "Philosophy of Style" might with profit be given experimental treatment, such, for example, as his observations concerning periodic and loose structure and the functioning of attention in grasping meaning. Rowland's [6] report on "The Psychological Experiences Connected with the Different Parts of Speech" also suggests more extensive investigation.

The enlargement of the span of the inner speech by the utilization in composition of the melodies and rhythms of oral speech or highly automatised colloquial habits is in line with the attempt to convey meaning with the least possible demand upon effort of attention. Through racial habits, words have become so thoroughly established in certain associative connections that if written composition adopts the style of oral speech, a glance of eye suffices to convey meaning and to induce apperception of the content. That the mind is active even in the regulation of ocular movements is shown by the fact that the eye moves by big jumps in taking in nouns, verbs, and adjectives familiar to the reader's associative habits but that it must fixate more hesitantly in reading prepositions and other connectives. A style weighted with many of these latter parts of speech will be slowly read in comparison with one that makes sparing use of relational words. A written style modelled closely after oral style will require as little effort to understand as your neighbor's gossip about household affairs.

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[2] "The Affective Values of Articulate Sounds," *Amer. Jour. Psychol.*, 1912, 23, 579-583.

[3] "The Psycho-physiological Effect of the Elements of Speech in Relation to Poetry," *Psychological Monographs*, No. 82, 1915, 1-132.

[4] *Amer. Jour. Psychol.*, 1916, 27, 430-434. *Ibid*, 1917, 28, 436-543.

[5] "The Psychological Attitude of Charles Dickens toward Surnames," *Amer. Jour. Psychol.*, 1918, 29, 337-346.

[6] *Psychological Monographs*, 1907, No. 32, 1-41.

An extensive utilization of oral speech rhythms and habits results from the custom of dictating one's compositions. The informal style of such composition may differ in many details from the closely packed style of labored composition. But it may have its limitations; its very transparency may not be an unmitigated virtue since the meaning conveyed may slip off consciousness as unobtrusively as the gossip to which we likened it. The speed with which a composition may be comprehended cannot be cited as evidence of all-inclusive merit. It by no means follows that all the effort of attention withdrawn from the form of an article will be given to its content. Content and form are too intimately associated for that. In art especially, form and content become one and in prose and poetry the intricate interweaving of word and thought may be as essential to the effect on the whole as is the combination of rhythm and tone in music. Limpidity of style may be quite distinct from conversational ease.

4. Rhythm. A detailed consideration of the psychology of rhythm has, of course, its place in a psychology of literature. Many possible applications suggest themselves. Patterson's[7] recent work with its suggestion of ways of testing the time-sense will occur to the reader.

5. *Literary Empathy.* As a general concept this involves consideration of the attitude of reader or author toward the characters and emotions presented in novel, drama, or poem. Three typical forms of reaction may be noted, although the complexity of relationships involved and the possibility of transitional forms should not be overlooked. There is, first, the detached attitude, that of the critical, and at times disinterested onlooker or spectator. Such a reader often projects himself visually into an imagined scene but when he does so he appears on the outskirts or margin. His reactions are cool and impersonal but often very constant and of critical value. There is, secondly, the reaction of the sympathetic

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[7] "The Rhythm of Prose," 1917, N. Y. *Columbia Univ.*, xxiii + 177.

participant who takes upon himself the emotions and conditions portrayed. There is warmth of personal consciousness, and rich organic and definitely egocentric application. The reactions of such reagents are apt to be variable, incalculable, since they may be blocked by momentary moods, or by the dispositional tendencies present at the time of reaction. A visual self-image may or may not constitute part of the reaction. There is, thirdly, a reaction which consists in intimate realization of the situation or emotion with its projection into the object or personality as a characterization of it. This is the esthetic reaction par excellence. It is, in its purest form, the rarest of the three. Visualization of the self is very infrequent in this third form of reaction for in this case the warmth of personal realization suffuses the object rather than the person who reacts.

Technical studies of the various functions of self visualization which have been made by Dr. Martin[8] should be carefully examined by the student of literary craftmanship. Investigations of the forms of self-projection occurring in literary appreciation have been published by myself.[9]

Many details of literary method find their explanation in the relation of self to the literary experience. The demand of the average reader for "sympathetic" characters testifies to his assumption of the participant attitude. So, too, the creation of the "arbitrary" character for plot purposes. Even so technical a matter as the telling of a story in first, second, or third person form must be canvassed from the standpoint of the relation of grammatical form to empathic participation. I have collected much material on this point, which cannot be cited here.

6. Hypnotic Devices. The suggestion that art makes use of many of the devices of hypnosis for achieving its effect is not a new one. I have, however, been interested in working out a program for listing and testing such devices, which would include not only the utilization of metrical effects, and the use of the Refrain in both prose and poetry, but also such applications as occur in the "gag" of the stage, the Dickensian stereotyped gesture, and above all, the utilization by the poet and dramatist, consciously or unconsciously, of the actual technique by which the hypnotist induces a state of fatigue or fascinated attention.

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[8] *Loc. cit.*, 483-513.

[9] "Literary Self-Projection," *Psychological Review*, 1912, 19, 298-311.

III. DIAGNOSTIC TESTS OF LITERARY ABILITY.

The search for such tests is one so recently initiated that at most one can but indicate the fields which the prospector may take over with some hope of success.

Thus Murphy[10] in "An Experimental Study of Literary vs. Scientific Types" has made an interesting attempt to discover diagnostic characteristics of these two types, by use of the association method. This method is capable of standardization and is most promising.

Gordon's[11] "Dissected-Story Test" might easily be made into a test of linguistic facility. Much of the work with Ink-Blots could be utilized in devising tests of the fertility and flexibility of the visual imagination. Ratings as to personal qualities of style might be obtained by application of Givler's[12] method of testing the auditory and kinesthetic effectiveness of personal tonal patterns; while Patterson[13] suggests a way of selecting by tests individuals with an "aggressive time-sense."

In my experiments on literary esthetics I have chanced upon a number of suggestions that might be developed into standardized tests of literary ability in its various forms.

Thus the imaginative versus the reminiscent type of mind is revealed by the percentage of free images released by reading properly chosen literary selections.

The prosaic mind may be differentiated from the poetic type by its reaction to various figures of speech. The latter type assimilates the figure in an emotional and sensuously rich context and frequently succeeds in achieving a fusion of different mental contents correspondent to the literal and figurative portions of the simile or metaphor. The prosaic or logical type of mind pounces upon a literary comparison as a thing in itself and often condemns it as incongruous. The ease with which such types of reaction may be uncovered is evident from the fact that students in my classes have been able by use of a simple questionnaire to identify the most literary- and the most literal-minded members of a group tested by them without previous knowledge on their part of the general make-up of their reagents.

An experiment that I have found of great value in giving me insight into the type of mind of student-writers consists in getting the freest possible reactions to a list of one hundred carefully chosen words. The following types are revealed. First, those subjects who react to the detached word by defining it or giving a synonym or some form of phrasal completion, a form of reaction very frequently found among subjects with a legal or scientific turn of mind. Secondly, a numerous group who respond with a definite image of the thing named or with a complex feeling of rich content, of incipient imagery. This reaction is, perhaps, the most common one and is definitely more concrete than the preceding. Thirdly, a few reagents show a tendency to treat the word as a thing-in-itself, quite apart from its meaning. They may react to it as to a visual form, a tiny arabesque of lines that may release attitudes as would bigger visual patterns. The bearing upon literary composition of such a reaction is not obvious, much less so than the treatment of the word as a musical tonal affair, with primary appeal to the auditory sense. A fourth group of reagents report emotional and mood-values for words rather than intelligible meanings. And in this connection a distinction is made between emotional words and so-called atmosphere words. One subject reports, "Emotional words give ME a mood or feeling. In atmosphere words this feeling belongs to the words themselves." A distinction which marks off, as in the case of literary empathy, the highly esthetic from the more crudely emotional attitude. It is among this last group of subjects that we must look for keenest sensitivity in handling words, although such sensitivity does not guarantee imaginative synthesis of material in plot structure or character creation. As an interesting sidelight it is worth while observing that these types of reaction to words in many respects parallel those discovered by Bullough[14] in his investigation of reactions to simple colors which he listed as (1) the objective; (2) the physiological; (3) the associative; and (4) the character reaction.

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[10] "An Experimental Study of Literary vs. Scientific Types," *Amer. Jour. Psychol.*, 1917, 28, 238-262.

[11] *Psychological Bulletin*, 1917, 14, 66.

[12] *Loc. cit.*

[13] *Loc. cit.*

That the Order of Merit Method in combination with correlational coefficients may be used in forming an estimate (1) of the esthetic taste of the reagent and (2) of his usableness as a reader for selecting productions that would be widely popular is shown by my experiments on the affective and esthetic judgment of poetry[15] and "Emotional Poetry and the Preference Judgment."[16] A recent report on "Experiments on a Possible Test of Aesthetic Judgment on Pictures"[17] indicates with considerable precision the exact course to pursue in working out a scale for measuring taste in its application to any sort of sensory material.

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[14] "The 'Perceptive Problem' in the Aesthetic Appreciation of Single Colors," *British Jour. of Psychol.*, 1908, 2, 406-463.

[15] The Imaginal Reaction to Poetry. *Univ. of Wyo. Bull.* No. 2, 1911.

[16] *Psychol. Review*, 1915, 22, 259-278.

IV. Stimulating Literary Invention

The proposal to stimulate the creative processes by an understanding of their psychology sounds somewhat fantastic, particularly to those intimately acquainted with the whims of the creative temperament. None the less it is a tempting proposition of applied science. What such a proposition really amounts to is the administering of training under guidance of a thorough understanding of the creative imagination in general and of one in particular. But if the program for diagnostic tests is as yet composed mostly of vague suggestions, the present program is limited to expression of vague hopes.

In part, of course, the devices for increasing literary productivity are identical with those that would be presented under any project for advancing mental efficiency: Economical ways of collecting and classifying material; development of habits of observation; schemes for overcoming inertia and mental laziness. Journals that deal specifically with the author's craft have much valuable advice to give along these lines. "Think into your typewriter," the student of journalism is taught at Columbia, an excellent habit to form if one would prevent the vapor of inspiration from diffusing itself upon the desert air. "Never stop at the end" is the advice of a prolific author who was wont to dovetail the end of one novel and the beginning of a new one. "Leave an unfinished sentence, an incomplete paragraph, a fragmentary chapter as a stimulus for your next period of work." Such admonitions convince us of the real insight embodied in the observation of a famous short-story writer, that many have a talent for writing but few talent for being a writer.

Let us attempt, however, an analysis at closer quarters of certain aspects of literary invention that are open to manipulation. So far as plot-making is concerned what is essential is the acquisition of the proper mental set. Such a patterning of consciousness may be very deliberately developed by proper exercise if one start with a modicum of capacity. One may learn to expand the conversation overheard on the street-car into a whole novel; one may acquire skill in persuading the Story-Book Girl seen on the Subway into returning to her home between cloth-covers by issuing the invitation again and again. One may, indeed, acquire the habit of having inspirations as one cultivates a taste for olives by a little initial heroism. In a number of cases I have had a chance to watch the plot-making set develop in students, in spite of the unfavorable conditions attendant upon a routine college course and limitations in the way of time. Usually within two years one can begin to notice considerable increase in facility and fertility in plot-construction. What might be accomplished by further extension of time I do not know since college authorities have a constitutional objection to one's inviting one's best students to indefinite repetitions of a course!

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[17] Cattell, Glascock & Washburn: "Experiments on a Possible Test of Aesthetic Judgment of Pictures." *Amer. Jour. of Psychol.*, 1918, 29, 333-336.

The mental synthesis underlying character-creation lies at a deeper level than that of plot-synthesis. It centers, I suspect, in the instinctive life of the individual. Investigations on the imaginary companions of childhood have given me some suggestions as to possibilities in the way of exploration of tendencies but as yet no confidence in any method of stimulating character-synthesis.

Quite as important as the acquisition of proper mental sets is the control of inhibiting ones. The inhibition of one attitude by another is the underside of that doctrine of formal discipline so dear to the popular mind and so little emphasized in its unfavorable aspects. If the attitude of suspended judgment and infinite caution inhibits confidence in one's inspirations let us recognize the dangers of scientific training for the poet. If psychologizing inhibits dramatizing, let us psychologize with discretion. If, on the other hand, inhibition of any particular mental set be due to ignorance of possibilities in the way of manipulating different sets of mind, let us discover the proper methods of manipulation. If necessary, we may emulate William Sharp and synthesize our critical tendencies into one personality and our poetical into a Fiona MacLeod.

One of the strongest forces inhibiting creative work is self-distrust. Few realize that just being one's self is the likeliest way of achieving originality. How very great our unused possibilities are we may never realize until the brakes are thrown off by some strange accident of the spiritual life or by the momentary intoxication of wine or hypnotism or love. If we could discover a scientific and harmless method by which we could let ourselves go at will many of us might change from conventional everyday people into charming Patience Worths. If the Ouija Board be the best method for manipulating such transformation, by all means let us adopt it as a training instrument for the literary imagination! Something similar in the way of stimulating the imagination by sensory automatisms I have attempted occasionally, utilizing crystal-gazing and shell-hearing. My material is too meagre to justify a report, but it encourages further work.

James, apropos of his famous suspicions as to the range of human energies, has indicated in his delightful fashion the checking of activity by various forms of inhibition. "Social conventions prevent us from telling the truth after the fashion of the heroes and heroines of Bernard Shaw. Our scientific respectability keeps us from exercising the mystical portions of our nature freely." James suggests that we map out human possibilities, mental and physical, in every direction and then work out from biographical material the methods by which every type of man may be energized. The suggestion is worth following.

One of the most promising points of departure is the freeing of energies through the social instincts. We may recall Wallas' discussions in the "Great Society" of the possibilities inherent in collective thinking if we could once master its technique. Recent war-programs indicate that such technique has actually been evolved under stress of circumstances and that faith in the possibilities of social thought has more than justified itself. Collective imagining in the realm of the artistic has a more problematic sound, and yet it has frequently proved its value in dramatic and architectural achievements and in the making of epics and ballads.

The composite story, the product of class-invention, has in my experience proved definitely superior to what the average student is able to achieve alone. The fertilization of the inventive processes of one mind by those of another; the multiplication of associations by social suggestions; the general emotional stimulation due to social contact, deserves serious consideration as one of the most profitable means of energizing the student. Its technique should be worked out.

A NOTE ON MENTAL TESTS FOR NORMAL BOYS

By Forest Cooke, Nordhoff, California

In the hope that mental tests might prove to be of value in teaching normal boys, groups of serial tests, similar to those used by Wallin, were given at the beginning and close of the school year to the boys of the Thacher School. These boys were of high school age, supposedly normal in intellectual ability, with perhaps more than the average cultural advantages. The result of the tests was to establish norms which conform to those quoted by Whipple in his *Manual of Mental and Physical Tests*, but are in general above them. The improvement shown by different boys during the year was of interest and value to the teachers, as the tests themselves will probably be when we have had more experience in interpreting them. As it was, our judgments were in many cases confirmed or assisted by the results of the tests. A third advantage appears in the keen and wholesome interest awakened in some of the boys in improving their minds, similar to the interest which the physical tests, which we have been giving for some years, arouse in improving their bodies. There follow accounts of the several tests given.

I. *Association test*—write as many words as possible in three minutes:

			Fall			Spring	
Age	No.	Average	Best	Worst	Average	Best	Worst
17–18	15	63.3	79	50	70	90	54
16	14	54.3	76	43	64.1	76	41
15	12	57.2	78	39	60.1	78	46
14	7	46.3	55	39	53	74	35

These results are considerably higher than the published results of Pyle for normal boys. There is a distinct correlation with age and with what teachers would call brightness. The younger boys and the poorer boys were found to make much use of rhymes in making their tests. Of course, the most valuable part of the test was the character of the words in individual tests. It was interesting, for instance, to notice that the only boys who mentioned girls were the ones who in their daily life have least to do with them.

II. *Cancellation Test*—crossing out A's from Stoelting's forms No. 55031-E. Time 135 seconds:

Age	Average
17–18	159 out of 162
16	143 out of 148
15	138 out of 141
14	125 out of 130

This test shows direct correlation with age, also with what in individual cases, we call careful work. The boys who were poor in studies were also slow in this test. On the other hand, some good boys were also slow. The test is a good indication of the careful or "sloppy" boy. It also suggested in one case eye trouble.

III. Word Building — write as many words as possible in five minutes from given letters:

	Fall—a e o b m t			Spring—a e i r l p		
Age	Average	Best	Worst	Average	Best	Worst
17–18	17.9	27	13	23	29	16
16	15	23	9	19.1	24	12
15	16	22	10	18	24	13
14	12	19	3	16.3	23	9

These results are notably better than Pyle's.

There was clear improvement during the year, and an obvious correlation with age, but no certain correlation with excellence in studies.

IV. *Sentence Building*—write as many sentences as possible in five minutes, using three given nouns. (Masselon method).

	Fall (*citizen, horse, decree*)		Spring (*bell, ground, owner*)	
Age	No. of Sentences	Character of Sentences	No. of Sentences	Character of Sentences
17–18	6	19.0	8.8	21.6
16	4	13.6	6.8	15.4
15	3.8	14.2	6.9	16.1
14	3	16.4	5.6	14.0

The character of the sentences was determined by the number of words representing separate ideas. This test was valuable in individual cases to show the use of English and power of imagination. Some of the good boys, however, did poorly in this test. As in several others, the boys of sixteen did no better than the boys of fifteen.

V. *Addition* — Six sums of three five-digit numbers. Time 53 seconds, determined by the first to finish.

Age	Number solved right	Number attempted	Accuracy
17–18	2.1	3.2	65%
16	1.3	2.6	50%
15	1.0	2.0	50%
14	.66	1.6	41%

There is a very noticeable correlation with age; a much less one with studies, though of value in distinguishing the mathematical type of boy.

V. *Immediate Memory* — Memory span for digits, as in Whipple (p. 155, auditory method).

Age	Score in Mistakes
17–18	6.4
16	9.
15	12.3
14	7.

VI. *Deferred Memory Test* — The subjects in the spring were asked to make a list of all the tests which had been given in the fall. The result showed a surprising correlation with school work, but little or no correlation with age. The boys who were poor in studies were all of them very low in this test. Some boys, however, doing excellent school work, were only average in the test.

VII. *Antonym Test* — Twenty words selected from those in Whipple. Time 57 seconds, determined by the first to finish.

Age	Average No.	Best Record	Worst
17–18	16.4	19	12
16	17.7	19	11
15	13.6	18	9
14	12.7	17	8

There is a very exact correlation with age; to a certain extent also with excellence in studies. But the way the test was given worked against the slower, but not necessarily duller, boys.

VIII. *Immediate Memory* (*method of right associates*)—A list of twenty pairs of words was first read, then the first of each pair, the second to be written by the subject.

Age	Fall Av.	Best	Worst	Spring Av.	Best	Worst
17–18	16	20	12	17.2	20	12
16	14.3	18	9	15.4	19	10
15	15.7	19	10	15.9	20	10
14	16	19	12	16.1	18	14

This test did not show any correlation with age. Some of the younger boys did as well as many of the older ones. The boys who are poor in studies all did badly in this test.

IX. *Form Board* (*Goddard visual method*)

Age	Time First Trial	Time Third Trial
16–18	16.5	13.5
14–15	17.5	14.4

Of the fourteen-year-old boys 100% had improved after eight months
Of the fifteen-year-old boys 55% had improved after eight months.
Of the sixteen-year-old boys 74% had improved after eight months.
Of the 17–18-year-old boys 47% had improved after eight months.

The correlation between this test and excellence in studies is very difficult to see. More surprising still is that it seems to have no connection with excellence in baseball. It is, however, of personal value in determining the nervous, quick, or deliberate boys.

X. *Mirror Drawing* (*Tracing a star*).

Age	1st trial av.	Fastest	Slowest	5th trial av.	Fast	Slow
17–18	63 sec.	18	91	24	13	43
16	79	35	183	23	14	35
15	85	30	189	29	18	60
14	137	69	310	42	22	80

As a personal study this test was very interesting, showing traits of nervousness, carefulness, persistency, or lack of concentration. Its relation to intellectual ability seems, however, to be most uncertain. Boys who tried the test a sixth time after an interval of a day or two were invariably faster than they had been in their fastest trial.

The general result of these tests has been to encourage the belief that there are great possibilities in the study of normal boys. A knowledge of mental testing may become as important to a teacher as any other part of his preparation.

BOOK REVIEWS

Leo Perla. *What is National Honor?* With a Special Introduction by Norman Angell. The Macmillan Company, New York, 1918, p. 211.

This is a timely book dealing with the problem of "National Honor" psychologically. "National honor is the fundamental casus belli and the challenge of reconstruction." Despite this fundamental importance it has heretofore been avoided. The question of national honor was omitted from the programs of the two Hague conferences; The League To Enforce Peace calls it "non-justiciable;" the Inter-Allied Labor Conference did not recognize it; and the general public has only a vague conception of it. Our author upon these facts attempts to define the problem and to determine a method of disseminating its purport aright, for it is "a bold and dangerous question." It is hard to deal with this question because it is emotional in nature rather than rational and therefore defies analysis and rationality. Because of this natural evasiveness (as shown by one hundred and thirty-five citations of views) of the problem, and the universal inertia of the average mind to grasp its importance, as well as that of diplomats to understand its psychology, a "new technique" is proposed.

Our author suggests by way of a technique, that the masses of all countries must get rid of the illusion that an economic sentiment is the motive of war. Universal peace is not to be hoped for in the face of this crass ignorance. Nor have statesmen and diplomats escaped this stupidity. The economic sentiment in regard to war "is a gross libel on human nature." There is an "ethical motor-spring" which transcends any economic consideration, and until this ethical consideration has been adjusted there will still be war. The fact is that men generally fight against the unprofitableness of war rather than for its economic advantage. "Men will fight not so long as they feel it is profitable, but so long as they feel it is right. This impulse to right, regardless of material consequences, is the fundamental cause of war."

National honor is the generic term for all the ethical motives of the nations. We must not lose sight of the evolution of national honor through family honor, group honor, etc., up to that high primitive conception spoken of by Fraser in his "Golden Bough." Now the technique for dealing with national honor must be based upon its biological significance, and in consideration of the factors which make for a changing conception of honor. These changes which national honor must undergo in the course of say a dozen generations are:

1. Unconscious modifications of the original concept by each succeeding generation. (Subjective variable.)
2. The changes produced by war, national institutions, etc. (Objective variable.)
3. Each nation has its own code of national honor.
4. Each individual has his own conception of national honor.

Thus rationality and the flood of passing events are only means of adding to the long founded original quantity, which is more or less unconscious. Therefore "when men go to war, though they know their country to be wrong rationally, it is not human nature for them to really believe so." The test of national honor for rationality is thus shown to give negative results at least in part, i. e., national honor is irrational to some extent, and is therefore psychological (emotional). Further tests of emotions show that next to their irrationality is their uniformity and universality. We may confidently rely upon these characteristics to tide us over all crises. The uniformity of emotional response goes back to the gregarious instinct (consciousness of kind). "The gregarious instinct kills more independent thinking than all the bad intellectual processes of our school systems." (p. 115.) "In a word it is about the consciousness of kind that all other motives organize themselves, in the evolution of social choice, social volition, or social policy." (117.) The directness of response to stimuli also shows the emotional characteristic of honor. "The sensitiveness of honor therefore can have no relation to the clarity of reason." Another important quality of an emotion is intolerance. Tolerance is a matter of reason.

The James-Lange theory of emotion cannot be applicable to the emotion of national honor, since there is no physical manifestation of a nation. If, however, we let the army represent the physical nation, an exact analogy may be assumed. Then we have a law of national honor: "The sensitiveness and intensity of a nation's honor increases directly with a recognition of its relative military strength, and inversely with the consciousness of the strength of an opposing Military Power."

In accord with this law we find Germany since 1907 increasing her national honor in direct proportion to the strength of her army. The great war from Germany's viewpoint is "a matter of honor" now that she is a "world power." The emotion of honor too is subject to abnormal development. Napoleon's "l'honneur et la gloire de la patrie" and the present day "Deutschtum" are cases. At such times we may infer that something is going wrong with the political make-up of a nation, just as incipient physical diseases and pathological mental states react on each other in the human body. Where an individual for example has indigestion by reason of some unconscious fear (objectiveless emotion), he will create some object (make some excuse) for his weakening physical condition. It is not surprising then in the case of a nation suffering from a hypertrophy of the emotion of national honor, that almost any trifling excuse may be offered to explain erratic functioning.

Three courses are open to the future in regard to national honor. First we must evade the "tyranny of a phrase," and supplant the emotional elements by an International Code of Honor which shall be based upon universal principles of justice. Honor must be a concept capable of universal application. This will in turn imply international politics, and free discussion of points of honor within the nation. Also the moralized emotion of national honor will be a complex implying two parties—one nation cannot dishonor another without dishonoring itself. Secondly, an International Code of Honor may be brought about by all nations submitting all the elements of foreign policies which if disputed would involve national honor. At the hand of a Court of International Honor such policies would be stripped of all the dangerous emotional elements, and tend to rationalize international politics. A third procedure is to find an emotional equivalent for this "honor" emotion which has caused so much trouble in the past. Men love a good fight with all its dramatic possibilities and its hazard of success or failure. The national expression of this fight is war. Here it is possible to "either check pugnacity or change the end, by resetting the scenes of international policies."

J. W. Sprowls.

Clark University.

JOSEPH PETERSON and QUENTIN J. DAVID. *The Psychology of Handling Men in the Army.* The Perine Book Co., Minneapolis, 1918, p. 142.

According to the title page, "the manuscript of this book was submitted to the War Department and permission for its publication for distribution among Army officers and soldiers was obtained under date of May 14, 1918." In the Preface the authors describe the general plan of the book in the following words: "The general plan has been to have each chapter, with a few exceptions, made up of three parts: the first by the junior author, an army officer (Lieutenant David), in a popular and somewhat personal style, to influence the young officers in the principles to be discussed; the second by the senior author (formerly Asst. Professor Peterson of the University of Minnesota) on the psychological bases of the subject considered, this to constitute the main part of the chapter; and part three to embody phases of more immediate application and also quotations, experiences and opinions of army officers which would be useful to those persons for whom the book is especially prepared. Some of the chapters, however, consist of only two parts."

The first chapter, which serves as a general introduction, deals with the subject of instincts, which, according to the senior author, "must be the basis of all appeals, of all stimulation to effort, to ambitions, to sacrifice, and to loyalty. Leadership, diplomacy, the ability to inspire men to superhuman effort, and greatest of all, the faculty of making friends and enjoying the world with them,—these are the results of proper appeals to instincts" (p. 12f.). This statement is the keynote to the discussion of such topics as "Competition" in chapter two, "Play" in chapter three, "Teamplay" in chapter four, and it also underlies much of the discussion in the other chapters. "Leadership" is the subject of the fifth chapter, the psychological discussion being based largely upon Cooley's consideration of the same topic in his book, "*Human Nature and the Social Order.*" The next chapter deals with "Principles of Learning," in which two classes of learning are distinguished and treated separately: "(1) the learning of practically new acts or of difficult combinations of acts only partly under control, and (2) the modification to a slighter degree and the perfection of habits or movements already under voluntary control" (p. 93). The topics of "Habit and Discipline," form the subject of chapter seven, and "discipline, as a condition in the men of the army, may be thought of," according to Peterson, "as a result of habit in the largest sense, including adaptation." But he immediately adds that discipline "involves not only ease and readiness and efficiency in the carrying out of orders, and in the performance of duties generally, but also endurance and *morale*" (p. 121). The last chapter which discusses "Loyalty," gives a rather abstract and more philosophical than psychological treatment and is perhaps the least satisfying of all.

In view of the authors' admission that their discussion "is necessarily incomplete and tentative in many respects," we merely wish to bring out two points by way of suggestion for a future revision. In the first place, the treatment of the whole subject of handling of men in the army has been limited too much to the case of the young officer confronted by new recruits in the army training camp. And in the second place, that great mass of psychological literature on the war, which has been published since the beginning of this war, especially in England and in France, should receive at least some recognition in a later treatment of this important topic. L. R. GEISSLER.

NOTES

The Summer Training School of Psychiatric Social Work conducted by the Boston Psychopathic Hospital and Smith College under the auspices of the National Committee for Mental Hygiene opened at Smith College, July 7th with an enrollment of 68 young women from 21 states and as many colleges. The purpose of the school was to give in eight weeks the theoretical background necessary to prepare social workers to assist in the rehabilitation of soldiers suffering from "shell shock" and other nervous and mental disorders. The courses which were offered included the following range of subjects: Social Service, Miss Mary C. Jarrett, Boston Psychopathic Hospital, Director of the school; Psychiatry, Dr. Edith Spaulding, Bedford Hills; Clinical lectures, Dr. J. A. Houston, Northampton State Hospital for the Insane, the clinics being held at the hospital; Sociology, Prof. F. Stuart Chapin, Smith College; Psychology, Prof. David C. Rogers, Smith College; Mental Tests, Miss Ruth S. Clark, Smith College. Additional lectures were given to the school by the following: Dr. E. E. Southard, Boston Psychopathic Hospital; Dr. L. Pierce Clark, New York City; Dr. Walter S. Fernald, School for Feeble-Minded, Waverley, Mass.; Dr. Adolf Meyer, Phipp's Clinic, Baltimore, Md.; Dr. William Healy, Baker Foundation, Boston, Mass.; Dr. A. A. Brill, New York City; Pres. Raymond L. Wilbur, Leland Stanford University; Capt. A. B. Bott, Hart House, Toronto, Ont.; Capt. C. B. Farrar, Cobourg Military Hospital, Cobourg, Ont.; Dr. James J. Putnam, Boston, Mass.; Dr. H. W. Frink, New York City; Dr. Abraham Myerson, Dr. Lawson Lowrey, and Dr. Josephine Foster, Boston Psychopathic Hospital; Dr. George Amsden and Dr. Charles Lambert, Bloomingdale Hospital, White Plains, N. Y.; Dr. George Kirby, Dr. H. A. Harrington, and Dr. Clarence Cheney, Psychiatric Institute, Ward's Island, N. Y.; Dr. E. Flood, Monson State Hospital, Palmer, Mass.; Dr. Albert Barrett, Psychopathic Hospital, Ann Arbor, Mich.; Dr. H. A. Mitchell, State Hospital, Warren, Pa.; Dr. T. H. Ames, New York City; Prof. H. N. Gardiner, Smith College; Dr. Frank P. Norberry, New York City; Dr. Herbert Hall, Marblehead, Mass. Of the 58 students who satisfactorily completed the course, those who had not previously had the required amount of practical work were assigned to the following clinics and hospitals for six months further training: Boston Psychopathic Hospital; Phipp's Clinic, Baltimore, Md.; Manhattan State Hospital, Ward's Island, N. Y.; Neurological Clinic, New York City; Massachusetts General Hospital, Boston, Mass.; Boston State Hospital; Boston Dispensary; University Hospital, Philadelphia, Pa.; Charity Organization, New York City; Cornell Clinic, New York City; Society for Organizing Charity, Philadelphia, Pa.; and Home Service, American Red Cross, Boston, Mass.

The Committee on Classification of Personnel in the Army has undertaken the publication of a weekly periodical, entitled "*Personnel*," the first number of which appeared August 21, 1918. According to an editorial in that first number *Personnel* will contain information on such topics as General Classification Work, Trade Testing, Personnel Needs of the Army, Assigning Men, Transfers, Rating of Officers,

Officers' Qualification Cards and important contributions to the field of Personnel."

Coincident with the conclusion of the armistice the publication of *Personnel* has been discontinued.

Hereafter instructions regarding personnel work in the field will be issued through letters, circulars and other standardized forms to the individuals concerned.

The personnel functions heretofore exercised by the Committee on Classification of Personnel in the Army will hereafter be carried out by the Personnel Branch, Operations Division, General Staff, with which the Committee has been merged.

The following item is quoted from *Personnel*, Vol. 1, No. 10, Oct. 23, 1918: "The new school for training personnel officers will be opened at Camp Sherman, Ohio, on Saturday, Oct. 26th. The 67 men in this school have all been selected and no further applications are being considered."

We quote the following from a speech by the Hon. George M. Young of North Dakota, in the House of Representatives, September 14, 1918:

"Upon our return here I concluded to see at once what had been done in our own country in respect to the rehabilitation of disabled soldiers. First of all I called at the Surgeon General's office, where I found that educational work was being carried on for the mental and physical rehabilitation of disabled soldiers in 15 of the United States Army general hospitals. Surg. Gen. Gorgas first of all laid it down as a foundation principle that physical reconstruction should be defined as 'complete mental and surgical treatment carried to the point of maximum; functional restoration both mental and physical, and to secure this result all methods recognized by modern medicine conducive to cure should be utilized.' In other words, not only the ordinary means of medicine and surgery, including all specialties, but also all physical measures which are employed under physiotherapy. He declared that modern medical treatment does not end with physical cure, and that functional restoration is the final aim of the modern physicians and surgeons. Surg. Gen. Gorgas declared that the physical rehabilitation of disabled men is peculiarly dependent upon their mental attitude, and that the educational work should begin therefore when the man has arrived at the stage when he begins to worry about his future, whether in this country or overseas. He said the first problem is to divert the man's attention by simple recreation, through reading, pictures, games, handwork, and the like, with the view to securing a genuine interest in the attaining of some worthy end, the end most certain to hold his attention and claim his best efforts in his future avocation. Hence by gradual steps he may be induced to supplement his previous vocational experience by academic, scientific, or technical instruction, or to choose a new vocation and begin preparation for it, if such a course is necessary.

"Upon this broad foundation it is natural to expect that our reconstruction work in the United States will be more extended and comprehensive than the work done in Great Britain."

In the preceding issue of this *Journal* we published a partial list of members of the American Psychological Association who are engaged in National Service of various kinds. In response to our request for information concerning errors or omissions we have the following corrections and additions to report:

Corrections:
Dockeray, F. C., Captain, S. C.
Dunlap, Knight, Major, S. C.
Johnson, H. M., Captain, S. C.
Myers, Garry C., Lieutenant, S. C.

Additions:
Angier, R. P., Captain, S. C.
Batson, W. H., 2nd Lieutenant Infantry.
Cameron, Walter, Major, M. R. C.
Langfeld, Herbert S., Y. M. C. A.
Meyer, Max, Captain, S. C.
Norcross, W. H., Lieutenant, S. C.
Reeves, P., Lieutenant, S. C.

Last summer the California Society for Mental Hygiene was founded under the presidency of Dr. Lillien J. Martin, Consulting Psychologist, San Francisco. "The purposes of the Society are to work for the preservation and restoration of health in those suffering from mental disturbances; to prevent mental diseases and deficiency; to help raise the standard of care for those in danger of such disorders; to familiarize the public with the proper treatment of persons afflicted with mental difficulties." The last named purpose is to be accomplished in part by a series of publications which aim "to furnish a suitable medium for the dissemination of the ideas of specialists and practical workers in group and individual mental hygiene." Among the first publications issued is a pamphlet on "The Training of the Emotions" by Dr. Lillien J. Martin. These publications may be obtained without cost by application to the secretary, Miss Julia George, 838 Phelan Building, San Francisco.

Earlier in the year the Council of the American Psychological Association had voted that on account of the war the annual meeting of this Association at Christmas was to be omitted this year. After the signing of the armistice, the Council reconsidered its vote not to have a meeting this year. It has now been definitely decided to hold a brief and somewhat informal meeting at Baltimore, on Friday and Saturday, December 27th and 28th.

The sessions will take place in Room 305, Gilman Hall, Homewood, Johns Hopkins University. The annual dinner will be on Friday evening, December 27th, at 6:30 p. m., at the Southern Hotel.

The program has been limited to papers upon psychological work in connection with the war. Owing to the short time at the committee's disposal, it has asked a number of members in service to present papers, instead of following its usual custom of sending a general notice to the members of the Association. A number of members have already consented to read papers, and the meeting promises to be an interesting one. The general scheme for the program is as follows: Friday, December 27th, at 10 a. m.—a parallel session with sections H (Anthropology and Psychology) and L (Education) of the American

Association for the Advancement of Science; Friday afternoon—a joint session with these sections; Friday at 6:30—the annual dinner followed by a business meeting and smoker; Saturday morning at 9:30—a joint session with Section H; Saturday afternoon—a symposium upon "The Future of Pure and Applied Psychology."

Friday at 4:30 p. m., Professor E. L. Thorndike, the retiring vice-president of Section H, A. A. A. S., will deliver an address entitled, "Scientific Personnel Work in the U. S. Army." At 7:30 p. m., Professor E. F. Buchner, the retiring vice-president of Section L, will deliver an address entitled, "Scientific Contributions of the Educational Survey." Among others, will be papers upon the work of the psychological examiners, upon the methods of the Committee on Classification of Personnel including the trade tests, upon the work of reconstruction, and upon the investigations in connection with aviation.

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